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ABSTRACT

This document consists of the five consecutive issues of the journal "Imagine..." published during volume year 3. Typical journal articles cover teaching academically talented secondary students in the following focus areas: (1) learning anywhere and everywhere; (2) accessing distance learning; (3) developing talent in the arts; (4) considering magnet schools and early college entrance; and (5) pursuing writing opportunities. Sample articles include: "Designing Your Own Education"; "Putting Together the Pieces" (Megan Moore); "Parents Can Help Meet Their Children's Intellectual Needs without Taking Away Their Childhood" (Barbara Rasmussen); "The Homeschooling Lifestyle" (Vivian Bush); "Homeschooling at Snowy Fields Farm" (Susan and Pegi Ficken); "'It's Academic!' What Being on a Quiz Bowl Team Has Done for Me" (Atish Choudhury); "Veritas?" (Megan Moore); "Accessing Distance Learning: Whatever, Whenever, Wherever You Want"; "The Pedagogical Promise of Computer-Based Education" (Raymond Ravaglia); "Exploring Career Options: Choosing Your Lifework" (Carol Blackburn); "Exploring Career Options: Focus on Writing" (Lesley Mackay); "A Palette of Many Colors: Brightening Your Life with Training in the Arts"; "Music: A Bridge between Two Worlds?" (Wayne Parker); "Language, Music, Mathematics, and the Brain" (Carol Blackburn); "Special Schools for Intellectually Talented Adolescents" (Julian C. Stanley); "I Was a Teenage Magnet Student" (Atish Choudhury); "Early College Entrance: No Regrets" (Alexander I. Saeed); "Early College Entrance: Is It Right for You?" (Linda E. Brody and Julian C. Stanley); "Life in the Too-Fast Lane" (Keetje J. Kuipers); "Overheard at the Finalists' Exhibition: 55th Annual Westinghouse Science Talent Search" (Carol Blackburn); "Exploring Career Options: Architecture, Landscape Architecture, and Exhibit Design: Interview with The Portico Group" (Carol Blackburn); "Your Words in Print" (Susan Hellerman); "The Talent Trap" (Stephanie Davis); "The Poet as Scavenger, Alchemist, and Agent" (A. V. Christie); "An Issue in the Life of the Hopkins Razor" (Elisa Beller, Nick Nash, Cara Gitlin, Lauren Pistell); "Destination: Publication" (Sara Yamaka); "A Summer at Spare Change" (Christopher Amar); and "Exploring Career Options: Biological Research Using

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Molecular Biological Approaches," "Focus on Biological Research: Interview with Corey Goodman: Developmental Neurobiologist," and "Focus on Biological Research: Interview with Bert Vogelstein: Oncologist" (Carol Blackburn). (LC)

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IMAGINE

OPPORTUNITIES & RESOURCES FOR ACADEMICALLY TALENTED YOUTH

VOLUME 3

NUMBERS 1-5

SEP/OCT 1995 – MAY/JUNE 1996

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VOLUME 3 • NUMBER 1

Opportunities and Resources for Academically Talented Youth

September/October 1995

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Spotlight On

LEARNING . . . ANYWHERE & EVERYWHERE

Out of the classroom and into the pony cart, Christopher Ficken and his siblings learn at all hours of the day through homeschooling in Wilson, Wisconsin (p. 11)

Too often, our culture conceives of education as a discrete set of facts to be funneled into a student who sits at a desk in a classroom for six hours a day, five days a week, during what is called the academic year.

In truth, education takes place every waking moment of your life, literally anywhere and everywhere. It needn't be a structured process, and optimally, it shouldn't be a passive one. What—and how—you choose to learn not only enhances your intellectual growth, but also helps define who you are and who you become.

For this issue, we asked some of our readers to discuss ways in which they have expanded the educational process by supplementing and/or stepping outside a standard academic curriculum. These particular writers have chosen such options as acceleration, enrichment programs, specialized schools, extracurricular activities, academic competitions, homeschooling, and volunteer service projects to extend their comprehension of the world and to foster their own growth.

None of these articles is intended to be used as a blueprint for your own education. Rather, we hope that by reading about the experiences of others you will gather enough insights and ideas to create the unique educational model that best suits you. ■

Mark Your Calendar

. . . with these October–January registration deadlines for selected academic competitions. (Other January–May deadlines will appear in our next issue.)

DEADLINE	COMPETITION
October	**United States Academic Decathlon** (Schools register teams, grades 9-12; state deadlines vary): 11145 183rd Street, P.O. Box 5169, Cerritos, CA 90701-5169; (310) 809-4995.
October	**Future Problem Solving Program** (Schools register teams, grades 7-12): 318 W. Ann Street, Ann Arbor, MI 48104-1337; (313) 998-7377.
October 15	**National Geography Bee** (Principals register schools, grades 4-8): National Geographic Society, 1145 17th Street, NW, Washington, DC 20036; (202) 828-6659.
October 15	**American Junior High School Mathematics Exam** (Schools register, up to grade 8): Dr. Walter E. Mientka, American Mathematics Competitions, Department of Mathematics and Statistics, University of Nebraska, 1740 Vine Street, Lincoln, NE 68588-0658; (402) 472-2257, fax (402) 472-6087.
November 10	**MATHCOUNTS** (Schools register teams, grades 7-8): MATHCOUNTS Registration, P.O. Box 441, Annapolis Junction, MD 20701; (301) 498-6141. All other questions: MATHCOUNTS Foundation, National Society of Professional Engineers, 1420 King Street, Alexandria, VA 22314-2794; (703) 684-2828.
November 15	**U.S. Senate Youth Program** (Each state nominates two delegates and alternates in grades 11-12 who are elected student leaders): For information, contact your high school principal, chief state school officer, or office of DoD Dependents Schools.
November 23	**Knowledge Master Open** (Schools register, grades 5-12): Academic Hallmarks, Box 998, Durango, CO 81302; (800) 321-9218.
mid-November	**National German Test** (German teachers register, German II-IV): American Association of Teachers of German, 112 Haddontowne Ct. #104, Cherry Hill, NJ 08034; (609) 795-5553, fax (609) 795-9398.
December 1	**Westinghouse Science Talent Search** (Students enter individual original projects, grade 12 only): Science Service, Inc., 1719 N Street, NW, Washington, DC 20036; (202) 785-2255.
December 1	**ACSL Computer Science Contest** (Schools register teams, grades 12 & below): P.O. Box 40118, Providence, RI 02940; (401) 822-4312.
December 15	**National Academic Team Challenge** (English & History) (Teachers register, grades 9-12): Foundation for Scholastic Achievement, P.O. Box 3340, Iowa City, IA 52244; (312) 464-4812.
January	**USA Computing Olympiad** (School coordinators register, grades 9-12): Dr. Donald T. Piele, University of Wisconsin-Parkside, Box No. 2000, Kenosha, WI 53141-2000; (414) 634-0868. [Check out their World Wide Web page: http://usaco.uwp.edu/]
January 8	**National Greek Exam** (Schools register, levels one-three): Professor Ed Phinney, Dept. of Classical Studies, Box 33905, University of Massachusetts, Amherst, MA 01003-3905; (413) 545-5780.
January 10	**National Latin Exam** (Latin teachers register, Latin I-V): American Classical League/National Junior Classical League, P.O. Box 95, Mount Vernon, VA 22121.

NEW SUBSCRIBERS

CRAZY ABOUT IMAGINE?

WONDERING WHAT YOU'VE MISSED?

Our focus topics from the 1994-95 academic year included **"Mathematical Problem Solving"** (September/October), **"Humanities"** (November/December), **"Academic Summer Programs"** (January/February), **"Science & Technology"** (March/April), and **"Foreign Languages & Study Abroad"** (May/June).

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Imagine...
*Opportunities and Resources for Academically Talented Youth**

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Designing Your Own Education

One-size-fits-all may be okay for T-shirts, but it doesn't work well in education.

Even those students described as "academically talented" are not cut from the same mold. Patterns of abilities vary greatly, as do individual characteristics: interests, values, motivation, goals and aspirations, personality traits, and learning styles.

As an academically talented student, you—no less than others among the school-aged population—need and deserve a highly individualized educational plan. You need and deserve access to coursework that is at a level and pace appropriate to your abilities. You need and deserve intellectual stimulation that will engage your curiosity and broaden your horizons.

Unfortunately, what you need and what you get don't always match. Schools are rarely prepared to provide the range of options ideally suited to each and every member of their widely diverse student population. Exceptionally talented students, in particular, are often such a small minority that developing a totally differentiated program for them is out of the question.

So what do you do? Don't give up; take control. For you and others like you, designing your own education may be an essential act of self-preservation, as well as a process of self-discovery and personal growth. Once you have taken the time to know yourself, define your own needs, and become aware of what's available, you will be able to construct the education that truly serves you.

- **Push the resources of your school to the limit.** Take advantage of—or advocate for—honors and Advanced Placement courses or an International Baccalaureate program. Request curricular flexibility to take higher-level courses with older students. Train with school teams for academic competitions. (Don't have one? Start one.) Offer to write for the school newspaper or literary magazine. Be on the lookout for teachers who could become mentors. Take up a musical instrument. Play a sport.

- **Access the resources of your community.** Talk with career professionals among family friends or neighbors who may be willing to tutor/mentor you. Form after-school groups with peers who share your interests in creative writing, role-playing games, computer languages. Investigate advanced or credit-free courses available through the nearest college or university. Check the paper for visiting lecturers and classes sponsored by local museums. Delve into the limitless resources available through that storehouse of freebies, your public library. Read, read, read.

- **Explore service opportunities.** Volunteering can be as simple as shopping for or reading to an elderly neighbor, as complex as coordinating a community-wide recycling program or organizing local businesses to respond to the needs of the homeless. You may be surprised how much you can learn and how good you'll feel while you're doing a good deed.

- **Look beyond the horizon.** Consider academic summer programs and correspondence and distance learning courses offered by regional talent searches and the extension offices of certain major universities. Scan the TV schedule for public access stations that include videotaped college classes. Find ways to travel, whether down the road or around the world. Gain computer access to files at the Library of Congress through Gopher; browse the World Wide Web.

- **Save time in your day for reflection.** Ask questions, ponder the responses of others, then seek your own answers. Keep your eyes and ears open, and don't neglect to notice what's right beside you. Take a closer look at the tiny universe existing in a cup of pond water. Savor the magnificent colors, textures, and shapes comprising a single flower. Tune in to the rhythm and melody of language.

Our world is vast and full of wonders. By paying close attention, you will be able to take full advantage of the best that it offers to teach you. ■

During the 1995-96 year,* Imagine *will continue to explore specific options from the overflowing cornucopia of educational opportunities available today. Watch for these selected highlights in coming issues:

NOVEMBER/DECEMBER 1995

Accessing Distance Learning

In-depth review of CTY's Expository Writing Tutorial-by-Mail and new Distance Learning Project. Survey of other correspondence courses available through talent search programs, universities, and the Internet.

JANUARY/FEBRUARY 1996

Developing Talent in the Arts

Exploration of ways in which *Imagine* readers combine intellectual and creative pursuits in the visual and performing arts. Competitions that focus on creativity.

MARCH/APRIL 1996

Considering Alternative Learning Environments

Examination of public/private schools, magnet programs, residential state schools, and early college entrance programs.

MAY/JUNE 1996

Pursuing Writing Opportunities

Suggested pathways for students who love to write, want to hone their skills, and long to see their words in print.

ALSO IN THESE ISSUES:

- **Exploring Career Options**—Beginning in the next issue, a new series featuring interviews with professionals well-established in careers in which *Imagine* readers have expressed interest.
- Return of the **Coach's Corner,** in which Chengde Feng provides mathematical problems tough enough for high-level competitions.
- More news about academic summer programs and academic competitions in mathematics, science, and the humanities.
- And as always, **Fascinating Classics,** college reviews, and **Creative Minds Imagine.**

Putting Together the Pieces

Academically talented students searching for educational opportunities have more options today than ever before. Here's one young woman who has chosen wisely—and widely.

by Megan Moore

You can't design your education in the same neatly ordered way an architect designs a house or a broker designs a stock portfolio. A "complete" education is not a check-off list of AP classes, extracurricular activities, community service projects, and interesting summer experiences—the clichéd components of today's ideal college application. Education is really about harnessing your capacities for exploration, enrichment, and introspection, then fueling them with energy, curiosity, and intelligence. It's about living out your potential as a growing, changing, thinking human being.

In designing your own education, you are in essence shaping yourself, carving out your own path through the world and influencing your perceptions of it. You can choose the books you read, the people you meet, the places you go, the friends you make, and even the backs of the cereal boxes you scan. You process all of this in tandem with all the other experiences of your existence, no matter how insignificant or subconscious (did you read your Cheerios box this morning?). And in so doing, you influence what and how you think. Insofar as human beings have choice about their lives, you choose who you are.

The thought of someone our age, not yet old enough to vote or buy a bottle of wine, being granted this sublime luxury of self-determination is intoxicating. (Who needs wine when you can have Plato?) That's why education is less about pure planning and design, and more about freedom, opportunity, and your appetite to do and be more.

Growing within Family

At seventeen, I can now say that I will make most of the decisions about where I go and what I do from here on (tuition bills aside!). My successes and failures will be my own. Yet opportunities I now have I owe largely to the tenacity and dedication of my parents, who provided me with the raw tools and foundation experiences that have enabled me to think and explore on my own.

I was fortunate enough to be born into a home with unending supplies of books, music, and lively (to put it mildly) dinner table conversations; to have parents who wanted to ensure that their children's minds and spirits did not stay confined within our quiet middle-class suburb. So my parents read to me every night until I could read on my own, then provided me with stacks and stacks of fascinating books—from the *Wizard of Oz* series to Agatha Christie to books on pedigreed dogs to French cookbooks. (I still remember my birthday party guests' bewildered faces as I beamed over yet another bizarre book.)

We were encouraged to conquer physical and intellectual challenges. My parents gave up a new house, a replacement for our old station wagon, and new clothes to share with my older sister and me their passion for exploring land and water worlds. They exposed us to realms and peoples and ideas unknown to most of our classmates.

Through their commitment, my parents were very purposefully providing sparks that they hoped would one day become self-sustaining fires of intellectual passion and self-betterment. This background in experiences and emotional support fueled my initiative and provided me with a frame for reflection and choice. Although it was my father who first pulled me out of a book and dropped me off at my initial swim team practice, I now strive to live by the words I heard so many times as a kid but never really understood then: "The body is the temple of the soul." I decided that I wanted to learn to play the cello, but only after years of listening to the music played in our kitchen, our car, and at the concerts our family attended. And I chose the college that I now attend, but only after my parents provided the educational foundation—as well as family college trips, college viewbooks and brochures, and most importantly, serious family discussions—to make it a reality.

Finding Peers

As I began to reach out beyond home and immediate family, my need for intellectual stimulation and the importance of my peer group became intertwined. First through the guidance of my parents, and later on my own, I sought out the company of dynamic and motivated students who would inspire me, peers I could admire and emulate, friends who embodied values I treasured.

Such people don't exist only in high-powered super camps and on television specials. I found intellectual challenge seekers in the AP and honors classes in my high school, in a wide variety of summer programs, and in weekend music classes at a local conservatory.

Taking Advantage of Available Resources

Fortunately, my high school had extensive honors and AP college-level course offerings in science, the humanities, and the social sciences, which provided a solid backbone for my high school years. If such a program does not exist in your school, ask why not. Agitate for change, then look for alternatives: acceleration, independent study, after-school tutoring and enrichment options, part-time enrollment at a local college, and competitive residential programs.

Look far and wide—in your community and beyond—to find programs that will keep your fires for knowledge burning. While expanding your intellectual horizons, you will also be surrounding yourself with other young people who care about the same things you do.

Check into classes at local universities and colleges, non-profit educational groups, conservatories, and private schools. (Most offer need-based assistance for talented and deserving students.) You could take a genetics class, research and write an original paper, or even perfect your conducting and sight-singing skills.

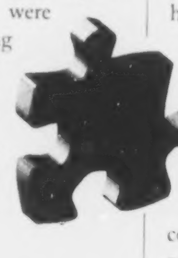
During several summers, I participated in the University of California-Berkeley's Academic Talent Development Program—first as a student, later as a teaching assistant. Talent search programs, Telluride, and the Center for Excellence in Education are examples of other organizations that are dedicated to helping talented students meet and stretch themselves.

Benefitting from the Academic/Peer Braid

The most incredible "independent" academic experience in which I was involved was the 1993 Research Science Institute (RSI). Held on the campus of MIT and sponsored by the Center for Excellence in Education, RSI brings together 60 or so students from around the world, usually the summer before their senior year. This full-scholarship six-week program of lectures and field trips is built around an intensive four-week independent research project executed under the guidance of a local mentor scientist.

I first learned of RSI through a CTY newsletter, and it changed my life immeasurably. Not only did I experience firsthand some of the joy, frustration, and complexity of research science, but I lived and worked with a group of friends who were extraordinarily talented, energetic, and reassuringly human. They introduced me to exciting options beyond the stable confines of my suburban high school, and they inspired me to strive for even greater challenges.

Sharing so much, we proved to be great resources for each other. After returning home, I came to rely on long e-mail messages to and from my new friends to help me get through the stress of senior year. Our paths crossed frequently while we were choosing colleges, competing for academic honors, looking for summer science internships. Most importantly, our relationships were—and still are—a source of support and understanding.



Stretching Yourself

Spending days buried in a book or a lab may "teach" you a lot, but a truly educated person is more than a collection of facts and theories. Stretch the rest of you as you stretch your mind. Challenge your fixed notions of the world with travel. Challenge your body with sports. Challenge your courage and self-confidence with risk. And feed your spirit with laughter.

Even if you can't afford to travel internationally, you can step out beyond your doorway by inviting others in. When my sister and I were younger, our family hosted exchange students from Thailand, Belgium, Japan, France, and Taiwan. I don't recall having intense discussions of international politics with them, but I do remember being intrigued by our guests' ways of speaking, dressing, and eating.

Later, a French teenager we had hosted invited me to visit for three weeks. Thrilled to be exploring Provence and the Riviera, I found myself in the midst of a vibrant, friendly family (whose rapid French stupified me as I struggled with the rules I'd so diligently studied in school). My sister, Erin, stayed with a family in Spain as part of a Sport for Understanding youth swim team exchange. We both took an incredible one-week trip with our cross-country team to Funa-bashi, Japan, where we lived, traveled, and ran with students from our sister school. And Erin, who attends Pomona College, will spend a semester next year studying ecology in Ecuador and the Galapagos Islands.

Opportunities such as these—to travel during long summer vacations or on high school/ college study abroad programs—may never come again. The financial support available through school programs/homestays and the luxury of time available to younger students will soon be replaced with the strains of graduate school and professional careers. So, while you have the chance, try something totally new, find a way to go someplace you never thought you could go, meet people and see things and have fun in ways you never expected. What are you waiting for?

Sports and other activities that offer a few hours of escape into intense physical exertion have been extremely important to me, and they also provide an education of sorts. All through high school, I swam and ran cross-country competitively. Now I swim on a Division III college team and scuba dive with my family. When my head throbs from thinking too much and a paper is due, a long run clears the cobwebs. When the world seems too complicated and I'm scared and bewildered, a swim soothes and refocuses me. And when I slip quietly down into the dark, cold, wet unknown of the sea for another exhilarating adventure, I stop caring about that wretched chemistry final and regain my balance.

Through sports, I have kept my body challenged and healthy, I have developed the courage to take risks, and I have had wonderful experiences of freedom, camaraderie, and pure joy. While I'm diving, I embrace the knowledge that I am a tiny, insignificant being in a vast ocean of organisms perfectly adapted to the underwater world in which I am only a tourist. While I'm swimming or running, I'm more than my GPA, released from all the expectations other people have of me as a student. Similar feelings can be found in taking a walk with a friend, going for a long drive on a beautiful day, gazing at a night sky, or laughing at a funny movie. Don't let your "education" get in the way of you.

And Relishing Sheer Enjoyment

As mythologist and educator Joseph Campbell recommended, "Follow your bliss." Do something you love; follow it where it may take you, using your love and enthusiasm to power you and your talent to keep you on course.

As a young child, I loved writing and would sit in my fourth grade class and write stories all day long, binding them up into little packets complete with titles and sketches, maps and floorplans. My parents, seeing the ember of a passion, helped nurture my love of language both by supplying me with wonderful books and by finding outside writing opportunities for me.

When I was 14, I participated in CTY's Expository Writing Tutorial-by-Mail (EWT) and learned the value of a one-on-one relationship with a dedicated mentor. That summer, I enrolled in a creative writing class on developing one's "voice" through the UC-Berkeley Extension. Since the instructor had agreed to stretch the 18-and-over rule to admit me, I found myself in a class of adults: men and women of all ages and careers and backgrounds, who shared a simple and honest passion for self-expression and exploration through the written word. The short stories of these real grown-ups had little in common with my teenage musings and instead were about torrid love affairs, ungrateful children, and wrinkles. While I spoke only once, to read the story I had written as my final project, this class opened a door into the world of "real writers."

My experiences that year, and later at RSI, taught me a lot about what it means to take charge of one's own education. I learned that I am the living expression of my own dreams, shaped and nurtured by the aspirations and efforts of my parents and teachers and friends. That a peer group is crucial to me and that, even when this group is dispersed across the country, it can provide an incredible network of ideas, inspiration, and friendship.That there is a whole world out there, full of new things to learn and people to meet and places to go.

So look around the corner, to a friend, into a book, at the university, on the Internet, across the country, and find something that challenges you and inspires you. Then, do it! ■

*During her senior year at Moreau High School in Hayward, California, **Megan Moore** was chosen a U.S. Presidential Scholar, National Science Scholar, and National Merit Scholar. She attends Williams College (see her essay about choosing a college, pp. 20-21).*

7

Parents Can Help Meet Their Children's Intellectual Needs without Taking Away Their Childhood

A mother recalls how her family coped with the educational needs of two academically talented children while honoring their individuality.

by Barbara Rasmussen

When Sara and Christopher were very young and we realized how bright they were, my husband and I struggled with what direction to take. At times we felt overwhelmed by our sense of obligation to them. Then I heard another mother recount her experiences with parenting gifted children. Since then, we have held on tight to her advice, particularly her very wise suggestion that parents "take heart, take naps, and take vitamins." Somehow, I also got the message to relax a little.

All parents have the same wish: that their children become happy, productive adults. But parents of extremely able children can face special challenges in guiding the development of their sons and daughters through the worlds of family, school, and society. In dealing with our energetic, sometimes impatient, gifted children, we have found that consideration for others—on the part of children and parents—can help carry the day.

Structuring Contributions of Family

Family relationships are extremely important to a child. For a while, they may be the only relationships that gifted children will trust.

Coming to terms with the differences among people was one of the first and most difficult struggles our children faced. In primary school, they perceived differences as unfair. They wanted the security of being just like the people they loved. We reassured them by gently pointing out that differing talents do not necessarily mean inequality and that differences are a fact of life.

We always had at least one meal a day together as a family. This made us famous among our friends, because the only meal that everyone could attend without fail was breakfast—every weekday morning at 6:00 a.m., everyone fully dressed. Dad left for work at 6:30. In the hour before school started, the children took care of their chores and practiced piano. I always sat with a cup of coffee and listened to these concerts. It was a lovely way to begin the day.

Just as I was resolving to prevent them from ever finding out that they are smarter than I am, it dawned on me that they had known this for quite some time. It didn't particularly worry them. Even the brightest young child needs help learning to tie shoes, avoid danger, and practice social graces. Then and later, they still looked to me for my experience, my judgment, and my care giving.

Defining Expectations

Their piano teacher once asked me about my expectations of their music lessons. I believe that is the most important question I was ever asked as a mother, because it forced me to think about my expectations in many other aspects of my children's lives. I decided that my musical expectations were that they should learn to love music, that performing should be a secondary goal. Their teacher agreed.

Sara played the trumpet, mellephone, French horn, violin, and piano in high school. Now in college, she enjoys piano lessons as a welcome contrast to her heavy science course load. Chris tried the trumpet, hated the violin, tolerated the guitar, composed several small piano pieces, and plays the piano skillfully. In high school, he joined the chorus and show choir. Now at college, Chris loves playing keyboard and kazoo in the Pep Band.

My point with this musical digression is to emphasize how valuable it has been for our children to invest a part of themselves in something that is pressure free, that they can own, that need not be more demanding than they choose it to be. Athletics, art, dance, and collecting things are other outlets for creativity that can enrich students' lives and perhaps lead to careers. Through the freedom to *explore* music, rather than *master* it, our children have found enjoyment, made friends, and learned self-discipline and self-respect. Music has given them the steadiness they needed when other things in their lives got rocky.

Negotiating with the School System

School is apt to be one of those rocky spots for gifted children. Our son complained that school was boring; he wanted to go faster. Our daughter thought that girls didn't get the attention that boys did. These complaints began in the second and third grades, and by the fifth and sixth grades, they required a great deal of energy to deal with. I believe the children's complaints had much merit. I also believe the school's response was sincere, even though the results were not always successful.

In their small West Virginia elementary school, Sara's flexible outlook enabled her to negotiate an enrichment program to her liking. The principal of the school was sympathetic, and the gifted teacher was superb. These qualities proved to be more important than material resources. Sara negotiated with her teachers for release time, acceleration, math by contract, and special projects. She wasn't afraid of the system, or the boys.

As a fifth grader, Sara developed a student council for the school and later served as a special delegate. In sixth grade, she started a tutoring program between older and younger students. She was a crossing guard; she played in the band. Sara finished sixth grade as a straight *A* student, winning the school's highest award, which cited her leadership and citizenship.

Chris found more success and happiness in a one-to-one relationship with a mentor who has become one of the most important people in our children's lives. Then a graduate student in the West Virginia University math department, this wonderful mathematician knew a million ways to keep mathematical curiosity alive, and she never failed to come up with just the perfect approach to new material. Sometimes she and Chris spent six hours a week together. This helped him cope with an unhappy second grade.

Honoring Individual Differences

It's hardly fair to blame the school for all his unhappiness, since things worked so well there for Sara. But our children are extremely different in outlook and temperament, so their educational planning needed to be flexible. Forcing Chris into his sister's mold would have been a grave mistake.

Chris was not interested in a widely diverse enrichment program like Sara's; he wanted to accelerate. He didn't have the political skills to negotiate when the luck of the draw landed him with unsympathetic teachers. By fourth grade, our son was increasingly unhappy. Rejecting our proposal to move him to another teacher, Chris suggested his own daring solution: he wanted to skip school occasionally. Simple and effective, his solution was also risky.

We decided to deal with Chris on his own terms, just as we had done with Sara. We explained that the school valued faithful attendance and that his grades would be of concern to us. He promised to keep his high grades, so we gave it a try.

He stretched a five-day bout with chicken pox into an eight-day recovery, but there was actually very little school skipping. Chris seemed satisfied with the control he had over whether to go to school or not. He was philosophic at the end of the term when he received the academic award, but not one for attendance.

The elementary school allowed him to take plane geometry at the local high school when he was in fifth grade. This pleased him and us, but inflamed many of his teachers and left him open to playground harassment he could not fathom. He said he hated school and refused to return for sixth grade unless changes were made. We began to negotiate with Chris, the school, and—inevitably—the truant officer.

That summer, I spent nearly six weeks in our university library, reading professional and academic literature on giftedness. Two messages were clear: (1) Intellectual needs must be met; and (2) good citizenship is an essential requirement for feeling secure in the world. Thus, we continued our previous pattern of setting non-negotiable standards of behavior for our children, while allowing them a great deal of latitude in educational decisions.

Disliking the slow pace of his schooling, Chris had become fearful and anxious. He proposed three alternatives: (1) He would stay in the school library all day and do his sixth grade work at his own pace; (2) he would skip to the seventh grade; or (3) he would be home schooled. The school rejected his first two suggestions, so he spent the next year at home.

A valuable hint: We were pleased to discover that, when Chris was classified as a home schooler, the resources of the public school system still remained available to him. So he was able to take Algebra II, computer programming, and keyboarding at our local high school. For two hours a day, he did seventh grade work using the accredited program offered by the Baltimore-based Calvert Correspondence School. (See Selected Resources on p. 12.) On Wednesday afternoons, Chris and his dad undertook a project of some sort. These projects were often billed as "physics" (but I know a box of Legos when I see it). Other times, they explored woodworking, rock polishing, philately, or the Atari.

Benefitting from Outside Resources

Although he was only eleven, Chris enrolled in the CTY Seventh Grade Talent Search that year and tied for the highest score in the state.

By that time, we were already sold on CTY because Sara had attended an academic summer program and found a wonderful group of friends. When things began to crumble for her in eighth grade, she was bolstered by her continuing contacts with those friends. CTY was to become a lifeline and an identity for Sara, who was learning that it can be socially expensive to be a smart girl.

It took all of our vacation dollars, and then some, to swing it, but when Sara went back for a second year at CTY, Chris went for his first. My husband and I were pleasantly surprised how much we enjoyed our time alone for those three weeks. Both kids came home with their self-esteem restored and an academic course behind them. At CTY, they had met hundreds of fun-loving, smart kids who liked them for their ability. This experience provided armor plating against pressure to "dumb down."

Renegotiating with the School System

Even at CTY, twelve-year-old Chris found himself in classes with fourteen-year-olds. Being two years younger was to become a defining characteristic of his education.

A year alone with his books was wonderful for Chris. But he decided on his own that having friends was of sufficient importance for him to return to public school and try to work things out socially. The catch was that he wanted to return as a ninth grader. And he wanted to take calculus. This time, Chris attended the placement meeting and spoke confidently before twenty or so teachers and administrators. His request was granted.

I believe that part of his growing confidence came from CTY's reassurance that sometimes very young children can do very sophisticated things. Part came from learning that the world is usually a tolerant place. While he was not excused from a citizen's obligation to become educated, Chris was free to help choose how to acquire that education.

And so it was that both Sara and Chris graduated from high school on the same day. But Sara had to come home from college to do it.

Because of her two CTY courses, Sara was able to take four AP courses in eleventh grade, finishing all high school requirements except English and physical education. After much soul searching, she decided to enter college early and accepted Hollins College's invitation to be a Hollins Scholar (which included a substantial financial award). Single-sex education was a great confidence booster for Sara.

At sixteen, Chris became an Echols Scholar at the University of Virginia. Charlottesville's small town atmosphere is easy for a young student to navigate, and the support network offered to Echols students is quite impressive. After two years at Hollins, Sara decided to transfer to the University of Virginia. They are the best of friends and are both flourishing.

A few closing words of advice to parents of extremely able children: The adventures that await you will enrich you and make you wise. Keep these years close to your heart. Even if they now seem to drain you of energy, someday they will make you smile. ■

*West Virginia resident **Barbara Rasmussen** is a writer and historian who holds a Ph.D. in American history. She and her husband, Norval, a physician, enjoy playing bridge with Sara and Christopher, who are getting harder to defeat. ("Actually, the summer bridge tally has them down by about 2,000 points. Old age and treachery can defeat youth and ability every time!")*

Sara and Christopher Rasmussen take a break from their studies to prepare for a performance with UVA's Pep Band.

This student author discusses his personal opinions about the strengths and weaknesses of the very different academic philosophies and environments he has experienced while searching for ways to meet his individual educational needs.

Reflections

by Chris Douglas

As I am heading off to college in the fall, now seems a good time to stop and reflect on my education to date. My schooling has been somewhat unusual—I have attended five different schools spanning a wide variety of the educational formats available today. These have included Montessori and "democratic" schools, public and private institutions, and even a year of homeschooling. Each environment offers particular advantages for the bright student, while also presenting certain drawbacks.

From Montessori

My first experience with formal education came at age five when I entered a local Montessori school. Montessori is theoretically child centered: each child is observed independently and instructed in a manner and at a level appropriate to that individual. Children are very involved in their own education, as they are given the freedom to decide their own activities within a purposefully structured academic program. At any given time, they delve into those areas that most interest them, actively learning from an inner drive, rather than passively following a dogmatic and inflexible curriculum.

The resulting environment of academic excitement, for both teachers and students, contributes immeasurably to a child's lifelong love of learning and commitment to scholarship. The individual attention and flexibility allows students to move at their own pace and approach material in a comfortable and appropriate manner.

However, this adaptability can extend only so far, as it is limited by the flexibility and expertise of the instructor. Very bright students require material far beyond what is normal for their age. Unfortunately, the recognition and satisfaction of this need can be troublesome. The individual teacher becomes extremely important, as he/she can identify great talent and nurture it appropriately. Unfortunately, many private schools are relatively small and thus limited in the available range of instructors. There is no guarantee that a particular institution will have an appropriate mentor for the advanced child.

As mentors may or may not exist in the young scholar's areas of talent, parents and students must be constantly aware of the relative expertise of the teachers in any given environment. This expertise must extend far beyond the level of the material being explicitly taught to the child so that the teacher is prepared to recognize patterns of learning and development that would suggest changes in the content, rigor, or method of instruction.

The advanced student, especially when young, will logically progress most rapidly in a tutorial environment that focuses on the areas of the student's greatest ability. This tutorial could occur within the context of almost any school environment, but naturally is more easily arranged and maintained within certain philosophical frameworks. If an appropriate tutor-mentor does not exist within a particular institution or for whatever reason cannot work with the child, it is imperative that the parents locate either an outside instructor or another school.

. . . To a "Democratic" School

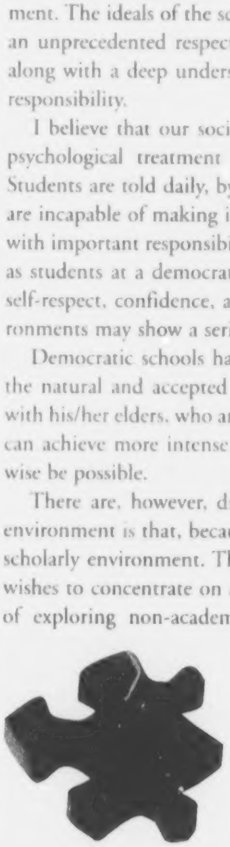
When I completed my Montessori education at age eight, I entered another alternative school—a completely "democratic" community, based on the philosophy that the child, and no one else, knows what is best for him or her. Absolutely. The students are completely free to determine their own activities, academic or otherwise.

Within this self-determining environment, students are treated with the utmost respect. They are assumed to be thoughtful, considerate members of the community and are given responsibility accordingly. Each student, whether five or eighteen, has a vote in the school assembly. The assembly decides everything for the school, from how school funds should be spent to which faculty members are invited to return each year. Students are forever changed by this remarkable environment. The ideals of the school become a part of them, and they absorb an unprecedented respect for themselves and everyone around them, along with a deep understanding and fundamental comprehension of responsibility.

I believe that our society has become desensitized to the alarming psychological treatment of children in traditional school systems. Students are told daily, by the very nature of the institution, that they are incapable of making intelligent decisions and are not to be trusted with important responsibilities. The snowball rolls either direction: just as students at a democratic school often develop remarkable levels of self-respect, confidence, and independence, students in negative environments may show a serious lack of these qualities.

Democratic schools have another important advantage. Because of the natural and accepted age mixing, the bright student can interact with his/her elders, who are closer in intellectual development, and thus can achieve more intense and fulfilling relationships than may otherwise be possible.

There are, however, drawbacks. The primary disadvantage of this environment is that, because few of its students are scholars, it is not a scholarly environment. This can present difficulties for a student who wishes to concentrate on academics, as most students are in the midst of exploring non-academic pursuits. Extreme discipline would be required to maintain a diligent schedule of studies in such an environment. And again, there is no guarantee that there will be a teacher who can suitably handle the advanced student's needs. Thus the student and his parents must be willing to search elsewhere for mentors.

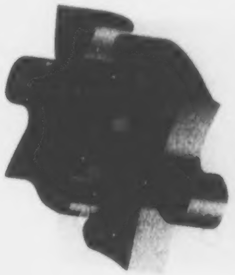


. . . To Public Middle School

When I was ten, I left this atmosphere of freedom and enrolled in the sixth grade at a local middle school. This particular public school was very supportive of my needs and, while they could not meet certain of them, they did whatever they could.

Public schools are often larger than alternative schools and, if they are flexible enough, may provide a range of opportunities and teachers for the student to explore. Unfortunately, there are a number of impediments associated with public education.

It is extremely rare for there to be exceptional teachers in all areas, so outside work or independent study may be necessary. Even intelligent and understanding teachers and administrators cannot always cope with the challenges of educating an extremely bright student. Due to the lock-step nature of the system, students often are forced into a predetermined pace of learning which they inevitably find far too slow. Even if the material being taught is appropriate to the child's level of knowledge, the pace can hinder his/her progress.



. . . Each environment offers particular advantages for the bright student, while also presenting certain drawbacks.

Contrary to the belief of many, grade skipping within the traditional school system does not solve the fundamental problem. It only delays the appearance of boredom and frustration from the lack of challenge. As soon as the student fills in any missed material, new ideas and concepts come at a pace appropriate only to the other students in the class. For an extremely able student to be consistently instructed at an adequate rate would require a system of individualized education all but unheard of in traditional school systems.

. . . To Homeschooling

When I was twelve, with the support and understanding of the public school, we began a program of homeschooling. There are many readily apparent advantages to homeschooling. The environment can be extremely flexible, and the student can receive a great deal of individual attention and instruction. Private tutors are a natural means for instruction and, if appropriate teachers can be found, homeschooling provides a perfect setting for these interactions.

When homeschooling is appropriate, the sooner it is begun, the more benefit a child receives. The young child can move at intellectual speeds far, far beyond the average if given a suitable environment. As the child gets older, this differential is somewhat more easily handled because more selective schools become available, such as top magnet or private high schools and exceptional universities. However, the challenges encountered educating the extremely intelligent child never go away completely, even at these institutions.

Social considerations are often raised as the most prominent or only reason for not undertaking a program of homeschooling or independent study. Proper social and emotional development is, of course, of great importance, and students—as well as parents—will naturally place a high value on such matters when weighing decisions involving schooling. However, for extremely bright students, assimilating into a traditional school environment may not satisfy these social needs, either. Although casual friendships with other students may develop, close relationships with true intellectual peers may be harder to find. Highly intelligent students must seek out stimulating companions wherever they are available so that social development is not bought at the price of stunted intellectual growth.

. . . To a University-Affiliated Private High School

After a year of homeschooling, I entered a newly established private high school located on the campus of a major university. In the first two years, students undergo an extremely rigorous education that includes a detailed study of the classics in language, literature, and history courses. The entire program is accelerated, and students begin university work in their third year, later graduating with up to twelve semester courses of university credit.

A rigorous school with an accelerated curriculum offers many distinct advantages. The teachers are often more highly qualified than at other institutions and tend to interact with students very differently. The deep understanding, the interplay of intellects, the expert presentation—these make for an experience unattainable in any other way.

In addition to the teachers, the availability of the university allows students access to course work far beyond that offered in other private schools. Another benefit comes in the high caliber of students who are drawn to this type of environment, as they contribute greatly to both the intellectual and social experience of the extremely bright child.

Unfortunately, no environment is perfect. Even here, there is no assurance that the exceptional teachers will span the disciplines or that all courses will provide sufficient challenge to the fast-learning student. What is more, the small size of the school, which greatly contributes to the formation of a tightly knit community, leads to a considerable amount of inflexibility in the curriculum. All students take basically the same course of studies until their senior year; accommodating students for whom this is not appropriate can be difficult.

. . . And on to College

I am now fifteen and am beginning the newest phase of my education this fall at MIT. For me, early entrance will provide an opportunity to accelerate my education, engage my mind, participate in a variety of fascinating activities, and meet hoards of interesting people all at the same time.

Admittedly, the appropriateness of attending college early, forgoing a "normal high school experience," depends on the student involved, but personally I have found most of society's worries about "normal"-this and "normal"-that to be misguided and completely unfounded. After all, wouldn't you hate to be "normal"? ■

Now a freshman at MIT, ***Chris Douglas*** *plans to major in . . . well, he doesn't know yet. His many academic interests include math, physics, neurobiology, philosophy, literature, classics, and art history. Outside school, he enjoys photography, skiing, skating, chess, reading, writing, and piano. In an effort to find more hours in the day, he plans to conduct some preliminary research on sleep deprivation.*

When families choose to homeschool—whether for secular or religious reasons—their decision must take into account the learning style and academic needs of the individual student, as well as the availability of parents and support resources. On these three pages, members of two homeschooling families describe their experiences with an educational format that may offer special benefits to some students.

The HOMESCHOOLING LIFESTYLE

by Vivian Bush

A time-honored practice is being revived in contemporary education and is gaining support: a growing number of students are learning at home, taught by their parents. I have been privileged to witness the growth of the homeschooling movement firsthand over the last seven years, as I myself have been educated at home since fifth grade. When people ask me if I like it, I answer yes—I have enjoyed a special relationship with my family that I wouldn't trade for anything.

Homeschoolers have made an impressive record for themselves. Studies have shown them to be high academic achievers, and some colleges, such as Hillsdale College in Michigan, have begun actively recruiting them.

But what is it like to spend all day, every day at home? Many of my friends have told me that they couldn't stand spending that much time with their parents, but I have found that extra time has led to a special closeness. My mother and I cannot stay angry with each other for long without being miserable, so we work out problems quickly. I know her not only as my mother, but also as my teacher and my guidance counselor. She has spent countless hours on the phone working out the details for many special academic experiences, making sure that I can develop my scholastic career to its fullest.

Thanks to my mother's hard work, I don't feel that I have missed any academic opportunities. In fact, the freedom of homeschooling has opened many doors for me and allowed for rigorous and challenging course work. We have used a wide variety of curricular materials, from computer software and videos (I watched a chemistry course in a conventional school on video; it's nice to have a teacher you can rewind!) to a calculus textbook from my mother's school years. I have taken the SAT twice, making a 1270 in seventh grade as part of the Duke TIP Talent Search and a 1520 in ninth grade. More recently, I scored 5s on the Advanced Placement exams in U.S. History, English Literature, and AB Calculus. After participating in an economics course for homeschoolers, I was able to aid my former teacher as a research assistant and as co-author of his latest book.

Because they set their own schedule, the Bushes were able to make a family vacation out of a college visit to Kentucky in September. (L to r: Dog Sadie, Vivian, sister Margaret, sister Nancy-Elizabeth, mother, brother Christopher.)

But I am frequently asked, "What about social life?" Many people seem to think that home education excludes the possibility of friendships, but I have made friends from church and from homeschool organizations. I attend Homeschool Christian Youth Association twice a month, where my friends and I play sports on the campus of a local community college. Our activities also go beyond sports—one Christmas we enjoyed a progressive dinner that featured a hayride from house to house.

Last year, I was elected to the HCYA Student Council, where I chaired the New Sports and Dress Code committees. In the summer of 1994, I went on a mission trip with my church youth group, where I spent a week in New Mexico and Arizona, painting a church and radio station and learning to live with 29 people in a four-bedroom house. (Talk about closeness!) This year, I will participate in Joyful Sound, the local homeschool choir, which performs concerts in banks, parks, churches, and at homeschool events.

But I have found my closest friend at school: my 14-year-old sister is my soulmate as well as my classmate. We have our fights, like most siblings, but we are still best friends. The homeschooling experience has also allowed me to know my six-year-old brother and five-year-old sister in ways that would not otherwise be possible.

Occasional problems have resulted from the fact that I am an "English person" in a family of mathematicians. My mother is sometimes frustrated by my eagerness to read a new book when I am supposed to be doing my Calculus assignment, and I must confess to a certain amount of daydreaming in the midst of long chemistry chapters. But, in working together, we have obtained a new respect for each other's subjects, which has probably given both of us new insights about unexplored aspects of the world around us. Her strong common sense has added realism to my writing style, and I recently inspired her to write a poem.

Homeschooling really does involve its own lifestyle. The whole family must put in extra hours to keep both home and school running efficiently. For instance, I sometimes babysit my younger brother and sister while my mother grades my latest test. We all contribute our time toward keeping the house clean, the endless laundry cycle moving, and the yard cared for.

A certain amount of sacrifice is involved in the homeschooling lifestyle. Some people wonder if it's worth it, but our family believes it is. We have strong religious reasons for homeschooling. By choosing our own curriculum, we are free to study the influence of Christianity on history, literature, and even science. I feel that my unique education has specially prepared me for a life of Christian ministry, which I hope to pursue someday.

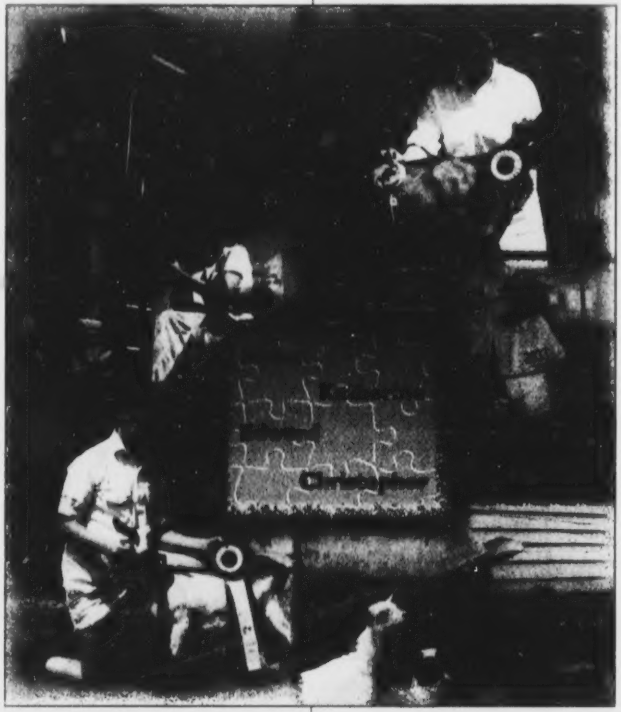
I feel that homeschooling has greatly enriched my life. Soon I will move on to new experiences in college, but I will never forget the special ties formed with my family during these years. I hope someday to pass the legacy on to my own children and give them the opportunity to discover the world they live in from the safe haven of their own home. ■

Vivian Bush *is a twelfth grader living in Houston, Texas. She enjoys listening to music, reading romance and adventure novels, and teaching a preschool class. Next year, she will attend Asbury College in Kentucky.*

HOMESCHOOLING AT SNOWY FIELDS FARM

This article evolved from a presentation on homeschooling given at last spring's Hollingworth Conference by Susan Ficken (14) and her mother, Pegi.

by Susan and Pegi Ficken



Susan: Beginning when I was four, I went to five different schools in a little over three years. The only one where I was happy—and the teacher was happy—was the first, a private school that was individually paced. In the year I was there, I went from kindergarten through third grade.

We moved over the summer. Because I have an October birthday, I wasn't even eligible for kindergarten. My parents found a school that would take me anyway, but it was pretty much a disaster. They told me at school that I could do anything I wanted. When I tried that out at home, it did not go over well.

Actually, it didn't go over that well at school, either. We were told we could choose from all kinds of toys and games and filing cabinets full of worksheets. I chose to play with all the games. At the end of the month, they told my parents that, because I had not chosen to do the worksheets, I was too immature to go to school.

After trying two other schools, my parents decided to homeschool my brother and me. I was seven, Edward was five. (Later, our two younger siblings, Katherine, then three, and Christopher, who had just been born, would join us.)

Pegi: Our decision to homeschool was not made lightly, nor was it made initially on philosophical grounds. It was purely a case of preserving our children. Fortunately, much of the time, parents and students can rely on the goodwill, fairness, and humanity of teachers and administrators. Unfortunately, we encountered a principal who didn't just ignore our children, but actively attacked them.

So we decided to homeschool. The support from others was tremendously underwhelming. We had no idea what we were doing or how to do it. We knew we wanted our children to learn certain things, but we didn't know how to teach them.

Some things were easy—reading, for example. Susan learned to read at age four, Edward at three and a half. When Susan was tested in school at age six, the reading specialist somewhat reluctantly concluded that there were no reading skills she did not possess and that her comprehension level was beyond grade 12.

Literature was a bit more difficult. Many books touched on, or were explicit about, subjects I did not consider appropriate for their age. Those that were age-appropriate were dumbed down. Many were very poorly written. Our solution was older children's books.

Susan: The beginnings of formal homeschooling earned mixed reviews. It was a relief not to have to go to school every day. Not to have to get on the bus and have Dominick punch me in the nose every day. Not to have to sit in a classroom every day. Not to have to stop the project I was working on because it was time to go outside and play.

However, Mom started out with this wacky idea—I don't know where she got it—that we needed to sit down and *work* at learning for eight hours a day. That was pretty gruesome. Luckily, it didn't last very long, because she read somewhere that the average schoolchild in Wisconsin only spends 25 minutes a day getting direct instruction.

Mom also broke her foot about that time and was on crutches for nine weeks. While she was laid up, Edward broke both bones in his arm and had to have surgery to set it. So no one felt too much like sticking to any schedules.

We did a lot of interesting things, though. We learned mathematics with Cuisenaire rods and parquetry blocks and played games in French, German, Spanish, Italian, and Latin. Mom ordered materials from Dale Seymour [see box] and came up with the brilliant idea of giving us each a folder full of work to be done during the week. If we finished our work by Friday, we would earn a book. If we finished by Thursday, we could go somewhere on Friday, such as to a museum or the zoo.

Pegi: As time went on, we found ourselves discarding more of our preconceptions and asking more basic questions, such as: Why does anyone need to sit and learn 'skills' just for the sake of learning 'skills'? If a child reads enough, will the child not, of necessity, learn 'reading skills'? And why shouldn't learning be geared to the interest of the child? Why should learning be miserable for a child because he/she is a child? (I'm reminded of the Calvin & Hobbes cartoon. Actually, I have at times felt as though my life were drawn by Lynn Johnston and Bill Watterson.)

Homeschooling for Excellence, written by David and Micki Colfax (whose three homeschooled sons went to Harvard), has shaped our philosophy and practices. They also wrote a book called *Hard Times in Paradise*, which, while not focusing on homeschooling, explains a lot more about how they developed their educational philosophy. (The Colfaxes also raise goats; one of Edward's big thrills was finding out that his foundation doe was descended from a Colfax goat.)

We began to think that we were on the right path, although there were times it could best be described as an unlighted cowpath with very steep dropoffs on either side.

Susan: Late in 1987, Mom read about a hatchery that was fairly close to our house. Because we lived on a lake, she thought that we should get a couple of ducklings and goslings to raise. This was really the beginning of our farm, even though we hadn't moved there yet.

We went to the county Extension Office and gathered up all the literature they had on raising ducks and geese, and I read it all. We kept the babies in a box in our sunroom under a heat lamp, and every day I had to empty the box and shred newspaper for their bedding. This was one of my first big lessons: *If you want to do something enough, you'll also do all the boring, yucky parts of it.*

Eventually, Mom saw an ad in the paper for the county fair. None of us had ever even been to one, but she entered my goose and Edward's duck. My goose won a blue ribbon. But Edward's Hickory Duck won Grand Champion Duck! We were hooked.

Pegi: If it hadn't appealed to Bill and me, we never would have moved to a farm five years ago. It may seem that this discussion has strayed pretty far from homeschooling. Not so. We finally came to the conclusion, contrary to the opinions and theories of some educators, that our children could and would learn at home, involved in the daily life of the family and the operation of a family business. And they have.

The 4-H program has been a major component of our children's education. In Wisconsin, 4-H is a family-oriented program featuring projects and activities chosen and somewhat structured by the child. Not confined to farm animals, program opportunities are limitless: electricity, woodworking, animal science, rocketry, sewing, cooking, and child development are just a few of the project areas offered. (Katherine went to her first national art competition at age seven through 4-H.)

At the end of each year, the kids put together 4-H record books that detail their projects—what, how, and why. Older students, fourteen and up, must include their financial records for each project and are also encouraged—though not required—to write a member evaluation: this is basically a résumé (good practice for later life) focusing on leadership. Writers of the best evaluations receive scholarships or trips to the state and national 4-H Congress. (For information on 4-H, call your county Extension Office or state land grant university.)

Susan: One of the best parts of living on a farm and being available so much is that I can be a contributing member of our family. I can participate in the management decisions—not only in the small, everyday decisions, but also in the long-range development of our business plans. We are designing an enterprise that can be divided into components, so each part can survive either individually or as part of the whole. Everything fits in well with our personal plans, too. At present, I want to be a veterinarian. While I am away at school, my area can be scaled down or temporarily eliminated. Later, it can be scaled up or restored.

Pegi: Meanwhile, our children are learning at a tremendous rate—because they want to. A good farmer needs to know elements of biology, chemistry, veterinary medicine, soil science, economics, accounting, and a few other areas. To market products privately, you need to have marketing and communication skills. History, literature, art, music, philosophy, and other areas are addressed also.

Our children have always taken enrichment courses, some during the summer, others during the academic year in the evenings. The University of Wisconsin at Eau Claire has many classes for young students. According to their philosophy, if children are interested in the classes, they should be there; if they don't belong, they won't come back. Susan has completed, and Edward is taking, their Math Talent Development Project, learning four years of high school math in two years on Saturdays, following Dr. Julian Stanley's SMPY program. It's been difficult, but very good for them.

Mark Twain said, "Never let your schooling get in the way of your education." We've tried very hard to follow that adage. "Educating" a highly gifted child is not so much a matter of teaching as of exposing, facilitating, and encouraging. I have seen very few children who were not eager and willing to learn—at least, until they started school. They may not have been eager to learn what their parents wanted them to know, but they were eager to learn something. Traditional schooling is geared to a child's learning what is on the teacher's agenda. At home, our children are able to learn about what interests them. ■

The Ficken family practices homeschooling and sustainable, humane farming in Wilson, Wisconsin. They presently have two cows, three heifers, two yearling steers, three steer calves, four veal calves, seven milking goats, 25 non-milking goats, about 50 sheep, myriad ducks, geese, chickens, and guineas, and a partridge in a pear tree. Bill Ficken (father) works as a technical systems support specialist for Unisys to pay the bills and does fencing and chores when necessary. Before beginning farming, ***Pegi Ficken*** *(mother) was employed as a chemical engineer, computer programmer, kidney dialysis technician, and newspaper columnist, among others.* ***Susan Ficken*** *may become a veterinarian or paleontologist, but will definitely be a goat breeder. She studied calculus at Purdue this past summer.*

Homeschooling is legal in all 50 U.S. states, although specific requirements vary state by state. For information, write or call your own State Department of Education and search out homeschooling associations in your area.

Selected Resources

- **Two homeschooling/correspondence programs** that offer curricular materials, student texts, and teacher's guides:
  Calvert School (K-8), *105 Tuscany Road, Baltimore, MD 21210; (410) 243-6030.*
  Dale Seymour Publications (K-8, 7-12), *1100 Hamilton Court, Menlo Park, CA 94025; (800) 872-1100 or (415) 324-2800, fax (415) 324-3424.*
- **Hollingworth Center for Highly Gifted Children**: a non-profit resource and support network for highly gifted or exceptionally gifted children, their families, schools, and other support personnel. Services include a monthly newsletter, information clearinghouse, regional parent support groups, consulting services, curriculum development, and social activities.
  Hollingworth Center for Highly Gifted Children, *P.O. Box 464, South Casco, ME 04077; (207) 655-3767.*
- **Growing without Schooling**, a bi-monthly magazine, and "John Holt's Book and Music Store," a catalogue offering books about education, including the Colfaxes' *Homeschooling for Excellence.*
  Holt Associates Inc., *2269 Massachusetts Avenue, Cambridge, MA 02140; (617) 864-3100.*
- **Home Educator's Family Times**, published five times a year; free subscriptions.
  Homeschool Support Network, *P.O. Box 1056, Gray, ME 04039; (207) 657-2800, fax (207) 657-2404.*

"IT'S ACADEMIC!"

WHAT BEING ON A QUIZ BOWL TEAM HAS DONE FOR ME

Academic competitions are another educational option for students seeking intellectual stimulation, in-depth learning, and peer interactions.

by Atish Choudhury

IT'S ACADEMIC

"It's Academic!" Champions (left to right) ***Gautam Mukunda****, team captain* ***Atish Choudhury****, and* ***Jonathan Schlaifer****, with Montgomery Blair teachers/coaches Michael Kravitz and R.B. Lasco*

"It's Academic!" is a televised high school quiz-bowl-type show played and broadcast in the D.C., Baltimore, Central Virginia, and Delaware areas. In each game, three teams of three players buzz in to answer questions on a variety of subjects, including literature, history, geography, science, art, and mathematics. Questions are often interrupted, and team members are encouraged to consult with each other before giving the consensus answer.

During the 1994-95 school year, the team from Montgomery Blair High School in Silver Spring, Maryland, won four games and captured the Washington, D.C., area championship. Their team went on to defeat the Baltimore and Central Virginia champions to win the 1995 "It's Academic!" Super Bowl.

A scenario: Two teachers sit together watching a broadcast of a quiz show. One says, "Wow! These kids are so smart! Where do they pick up these things?" The other takes a superior tone: "Smart! All they're good at is memorizing things and regurgitating useless facts!"

If I hear something like this, I am initially offended. But as I think more, I wonder sadly whether the second teacher may be right.

So does this mean that I wasted four years of my time in practice for a worthless outcome? That probably the greatest commitment in my high school career was a useless endeavor? That maybe I should have spent my time in something that could actually have helped me in some way?

At least in my case, these arguments are completely false. When I first joined the "It's Academic!" program, I was a freshman in a math, science, and computer science magnet program. I knew some math and science and a little bit about other subjects, but my knowledge was not very impressive. How could I predict then that I would now be able to place art movements in chronological order and match painters and paintings to their corresponding movements? Or know many of the writers of great literature? Or be able to discuss the causes and players of the major European wars of the last few centuries?

Being on the Montgomery Blair High School quiz bowl team opened doors of knowledge for me that I didn't even know existed. For those who think that knowing facts is pointless, let me give an example from my Origins of Science class. We were discussing other cultures, specifically the Chinese belief in their own cultural superiority. The question posed was, "If the Chinese were so anti-European, how did Marco Polo attain such a high government position?" Well, a quiz bowl question that might come to mind is, "Who was the ruler of China during the time of Marco Polo's visit?" The answer is Kublai Khan, a Mongol and thus a foreigner himself. A foreign ruler probably would not want local ministers and . . . you get the idea.

As one learns more and more, the facts begin to piece together to give a broader *understanding* of a subject. This is one of my goals in life: to gain a greater understanding of the world. Through science and math, one can learn about the world's physical workings, and through the arts, one can see the trends of human thought and society through time. In this way, I believe that knowledge can lead to wisdom.

As to whether quiz bowl players are "smart," maybe they're not. But to participate, they must at least have an interest in *learning;* there can't be any other motive. (As captain of the quiz bowl team, I didn't attract nearly as many girls as the captain of the football team.) To be a good player, one must be well versed in a variety of fields, so I am thankful to the program for giving me a broad base of knowledge that I probably would not have gotten in any other way, and for diminishing my ignorance just a little bit.

Of course, all of this philosophy of "It's Academic!" disappears when the studio lights shine on my face. Then, the idea of The Win takes full priority. The pressure and apprehension while waiting for the next question are truly a rush, especially when we get the question right. Nothing can really describe the feeling of winning the trophy after that period of tense anticipation.

I would probably do "It's Academic!" just for fun, even if I did not improve myself in any way. However, as I look back, I realize how much I have grown field by field. For sheer enjoyment and enlightenment, being on a quiz bowl team was truly a worthwhile experience.

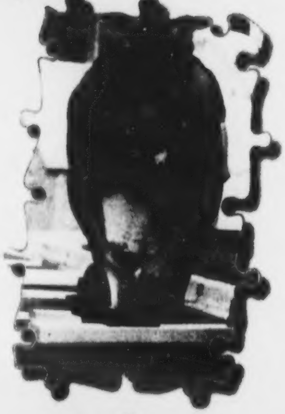
Or maybe I should have tried out for the football team. . . . ■

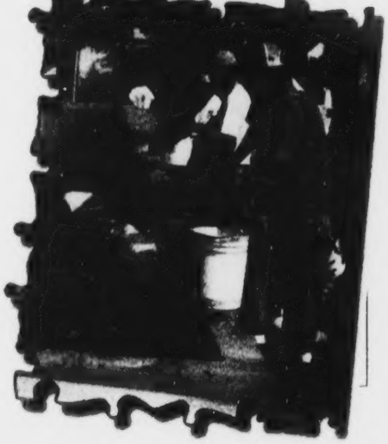
Atish Choudhury *graduated from the Math, Science, Computer Science Magnet Program at Montgomery Blair High School in June. Following his team's "It's Academic!" success, Atish co-captained the Maryland All-Star team that won third place in the Panasonic Academic Challenge held at Florida's Disney World. This fall he entered The Johns Hopkins University, where he plans to major in chemistry.*

Serving Your Community

Why be a volunteer? Perhaps you are grateful for your own good life and want to help improve the lives of others. Or you want to learn a skill, explore a career interest, assist your favorite political candidate, or tackle an environmental project.

Myriad volunteer opportunities exist in every community. If you're looking for a way to make yourself useful by contributing your time and energy, consider some of the possibilities discussed on these three pages—or check with your school, religious center, public library, or community organizations, such as Boy Scouts/Girl Scouts, for other options.





Habitat for Humanity

by Matt Wade

Picture this: Summer vacation. Hot and humid. You've got a hammer in your hand, your muscles are getting a real workout, beads of sweat are rolling off your face like a waterfall. And you're not getting paid.

Okay, so sweating in the hot sun for ten days without a paycheck isn't exactly everyone's idea of fun. But as thousands of Habitat for Humanity volunteers will tell you, these trips can be the best part of your summer. Not only will you have a great time, but you can also give something worthwhile to people who need help the most.

Don't worry if you don't have much experience with construction; many of the teenagers in our volunteer group didn't even know how to use a hammer when we first arrived. However, by the time we returned home, we all had successfully learned—thanks to the adult supervisors—how to put up wall board, shingle a roof, hook up plumbing and wiring systems, install floor boards and stairs, put in windows, and basically build an entire house.

Habitat for Humanity project sites exist throughout the U.S. Many service projects are sponsored by churches and other religious organizations, but you don't have to be a congregation member to participate. The project I'm involved in is Woodswork, which is sponsored by Woods Memorial Church in conjunction with Habitat for Humanity. When I first went on Woodswork, I wasn't a church member; however, because of the strong relationships I gained there, I later decided to join the church. I've gone on Woodswork twice so far and plan to continue in the future.

About a month before each trip, we have a car wash fundraiser. All the donations we collect go towards building supplies, travel expenses, and—most of all—food. Volunteers are usually housed in a local YMCA, church, or school near the building site. Yes, this means sleeping bags for ten days. We buy food supplies in a local supermarket and take turns preparing meals, so each person usually cooks about four meals during the ten-day period.

One of the greatest things about this experience is the interaction among everyone who works on the project, both those in your group and those you meet at the site. Habitat arranges for the prospective homeowners themselves to do up to five hundred hours of community service. It was a great feeling to work alongside the families who would be benefitting from our efforts.

If working hard and sweating under the hot sun still doesn't sound very tempting, remember that by sacrificing ten days of your summer vacation you can help create a well-built home and a more secure life for people who will never forget you. ■

Habitat for Humanity International
121 Habitat Street
Americus, GA 31709
(800) 422-4828

***Matt Wade** plays varsity football and lacrosse for Severna Park High School in Maryland. Now a senior, he plans to study sports medicine and physical therapy in college and looks forward to attending Woodworks '96.*

Children's Museum Docent

by Emily Witten

I have a great job, and I'm only fourteen: I'm a volunteer. It started when my mother brought home a newsletter about the Children's Museum in Houston, and we read about a new program there called the "Kids' Committee." We went to pick up an application and saw the brand-new facility decorated with bright colors, lots of windows, and open airy spaces.

A few weeks later, the museum called to schedule an interview with me. The style of the interview was very different from what I'd expected. Instead of individual interviews, we were called four at a time into a room with three adults and two older children. They gave us a made-up object and asked, "If this was a toy, what would you call it, what would you tell kids to do with it, and how would you package it?" We had to work in a group to come up with an idea.

The Kids' Committee was set up so that the Children's Museum could get kids' opinions on its exhibits and programs. Twice, we got to watch performers audition; we were asked to rate them and decide if they should perform at the Children's Museum. We evaluated exhibits; for example, one exhibit about machines and engineering had so many moving parts that the activities just couldn't be kept in working order. So the Kids' Committee decided it had to be replaced. We also represented the Children's Museum in the Art Car parade at the Houston International Festival.

What I liked about being on the Kids' Committee was the sense that we really could get things done. It made us feel important because we knew adults were listening to us and respecting our opinions. And our decisions really resulted in noticeable changes in the museum.

If you're a volunteer, you may already have discovered this, but before I started working with the Children's Museum, I didn't know that volunteering could actually be fun. ■

Because of her father's work, ***Emily Witten*** *has been spending summers with her family in Pau, France. She enjoys interacting with the local culture and has benefitted from speaking French for three months a year. Emily entered high school in Houston, Texas, this fall.*

School Volunteer Clubs

by Sophie Liao

Volunteering is a great way to get involved with your community. A few years back, I participated in a piano-playing marathon to raise money for those who suffer from muscular dystrophy. Then I really started becoming more involved this past year, as a member of several volunteering clubs that are run through my school.

One is called Students Against Drunk Driving, or SADD, for short. The purpose of SADD is to heighten people's awareness of the effects of drinking and driving. We put red ribbons up all over the community as reminders about the dangers of drinking and driving; we also arrange for speakers on drunk driving to come to our schools.

Another of our clubs is called Interact. This past year, the volunteering done by this club involved school functions, where we helped out at parent/teacher conferences and other events.

The third organization I worked through is Community Volunteer Service. This school-run organization can set up almost any type of volunteering job: I chose to tutor students in our middle school. It's a challenge for me to teach younger students something they haven't learned from the teacher. But there's a certain satisfaction I feel when I see the flicker of comprehension pass over someone's face.

Being a part of these service organizations gives me the knowledge that I am helping out my school, even if it's only in a small way. Some people shy away from volunteer work because it sometimes seems insignificant. However, remember that volunteering always benefits both you and your community. So it's a win-win situation all around. ■

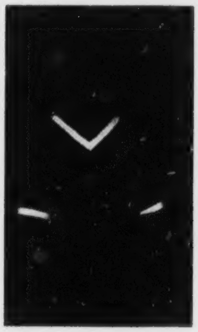
Volunteer Buddy for Multihandicapped Students

by Brian Schwartz

The Gateways program at my school helps students with severe mental handicaps learn basic life skills. I got involved with the program as a volunteer "buddy" because I wanted to help these students feel welcome in our school.

Once a week, I go to the Gateways classroom and work with one of the five students. Sometimes we practice skills such as folding towels, counting, or doing chores. We also do fun things such as reading a book or playing basketball. The buddies go with the Gateways class on field trips, and we enjoy holiday parties together.

This volunteer program benefits both the Gateways students and the buddies. Gateways students need to have friends their own age who will wave to them in the halls and sit with them at lunch, and they learn from doing simple tasks with their buddies. I enjoy volunteering as a buddy because I feel great knowing that I am making a small difference in someone else's life. ■



Ninth grader ***Brian Schwartz*** *attends Eyer Junior High School in Macungie, Pennsylvania. He has won academic awards in MATHCOUNTS, Science Fair, and History Day competitions. Brian is starting a business selling a table-top baseball game.*

This summer, ***Sophie Liao*** *and her family visited relatives in Taiwan where her parents were born. Now a tenth grader in Novi, Michigan, Sophie has won awards in math, debate, and piano competitions and hopes to study at the Moscow Conservatory's International Fine Arts Institute in Russia next summer.*

Kids Who Care

by Kate Beutner

Kids Who Care Club is a volunteering program run by two seventh grade humanities teachers in my middle school. Seventh and eighth grade students can select Kids Who Care Club as an activities option for one or both semesters.

During the weekly meetings, we usually make greeting cards for patients in local hospitals and nursing homes. We also plan other volunteer activities. For example, during one semester, Club members sold flowers at a hospital bazaar to raise money for an in-home nursing program, collected $450 in students' change at lunch for multiple sclerosis and cancer awareness programs, and organized a stuffed animal and toy drive for underprivileged children.

The Club's efforts have been quite popular, mostly because our entire school has the feeling that we can brighten someone's day. However, we also succeed in brightening our own days—many grateful recipients of our cards have written us thank you letters that make us feel very special ourselves. ■

***Kate Beutner's** poetry won her a National Gold Award in the Scholastic Writing and Art Contest. She also enjoys competing in MATHCOUNTS, Odyssey of the Mind, spelling bees, and science fairs. Kate is an eighth grader at Landisville Middle School in Lancaster, Pennsylvania.*

Lessons of a Friend

Sometimes what starts out as a simple effort to make someone else feel appreciated develops into an experience much deeper and more fulfilling for the volunteer.

by Rachel Israel

July 16, 1894—A date so long past, it seems it was pulled from a history book. To me, it is the date of my friend's birthday. She has just turned 101. Gertrude Marguerite Harmon: a friend who brings uncommon warmth and more than a century of experience to every conversation.

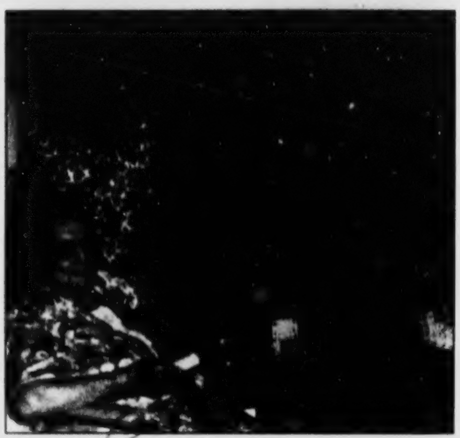
I first met Mrs. Harmon through a sixth grade class project. Our teacher, in a noble attempt to bridge the generations, had her fidgeting students hauled to a local nursing home. We sat down in a dining room, which quickly filled with the whir of tape recorders, to interview our assigned resident and construct a "living biography." Mrs. Harmon's personality was evident from the first day I met her, as she patiently told me of a time that I thought was so foreign, her story could have begun, "Once upon a time."

Born Gertrude Hartman, she was raised in Cleveland, the city in which she has spent her whole life. Her father owned and managed the J.H.R. Hartman meat-packing business, which prospered to the point where, when Gertrude was 11, the family moved into a 15-room house at 3000 Archwood Avenue. Her younger sister, Erma, and she delighted in 3¢ pony rides and the more mundane exploits of childhood, such as hide-and-go-seek and tag.

The more I learned about Mrs. Harmon, the more I understood that times gone by are not always times foreign. The life she described was a life that I, too, knew, for the simple joys of childhood are not confined to any era.

She speaks matter of factly, as one who has lived for more than a century can. When asked for advice for today's youth, she answers with a smile, "Would they listen?" Then she goes on to say, "It's all what you make of it—life, that is." Mrs. Harmon made her life one that she could revel in.

Gertrude always loved to sing. She captured the lead in almost every school play, sang in her Congregationalist church choir for almost forty years, and directed backyard plays (complete with admission charge). She gathered her friends around while she played the piano and the whole group belted out the songs of the day, sometimes even accompanied by others on the accordion and clarinet.



Mrs. Harmon and I pose for a photo at her 100th birthday party on July 16, 1994. The "living biography" that I wrote about her is pictured on the coffee table, along with some of 100 pink carnations she received.

As a child, she aspired to be an actress but, as she matured, chose to attend the Edminston Business College, enabling her to help with the bookkeeping of her father's business. At a public dance, she met her future husband, Lewis Harmon. When she was twenty-five, they were married in a small ceremony.

As Mrs. Harmon notes, the turning points in history that we today consider so great may not have seemed especially significant at the time. Remembering all the inventions and discoveries of her lifetime, Mrs. Harmon shrugs and says sweetly, "You go along with 'em. When they happen so gradually, you hardly notice." Listening to her, I've come to realize that, even though we live in a time of rapid technological progress, the essential milestones of people's lives are much the same over generations.

Gertrude never had children, and she never traveled much. She enjoyed bowling until the age of eighty-seven. She drove until she was eighty-nine, without—as she proudly notes—even one accident. She loved watching baseball and even today loves to play cards.

Mrs. Harmon hasn't had earth-shattering experiences or led the kind of life that changed the course of humanity. Yet, our friendship has helped me understand more about human nature than has any other friendship I've ever had. ■

***Rachel Israel** works on her school yearbook staff and competes in Lincoln/Douglas debates, Science Olympiad, and Academic Challenge. An eleventh grader at Magnificat High School in Westlake, Ohio, Rachel enjoys playing piano and violin, reading, and horseback riding.*

Journal of My Twisted Spine (continued from p. 24)

My mind whirls, out of focus. I have always thought of people who coped with physical disabilities as being different from me. Will I still have the same friends, be the same me, now that I know something is "wrong" with me?

Several days later, I sit in the ground floor waiting room of the x-ray lab in my hometown hospital in Sitka, Alaska. I am looking at a magazine article about hotels in New York City when a woman in a white medical coat calls my name.

Inside the lab, I put on a flimsy white gown and hold my breath, afraid to move while a gaunt man takes the pictures. I hold onto the hope that I am fine, that nothing is wrong with my back. So it feels like an arrow through my heart a short while later when the woman who called my name exclaims, "How awful!" My last hope of normalcy is smashed.

I dress and go upstairs to sit with my mom in Dr. Totten's office. I feel another blow when I see, propped up on a glowing screen, two x-rays of a spine as curved as a backwards S. A few of the vertebrae twist individually. I know that the x-rays are mine.

Dr. Totten talks in a strong Scottish accent. "Laura has a thirty-three-degree curve in her spine. I'm referring her to a specialist in Seattle." I tune out the rest of his words. As they begin to fade, I stare with burning eyes at his diplomas and thick medical volumes, evidence that the nightmare is real and not a mere dream. Dr. Totten and his x-rays are sure to be right.

Only four weeks later, I am on Alaska Airlines Flight 67 to Seattle with my mom. Of my parents, my dad knows the most about science and medicine, but my mom is more fun to shop with. The one bright spot in this dark trip is the prospect of new clothes. Living in a small town triggers daydreams of malls and boutiques. But my desire to shop, while great, is dimmed by my uncertainty about the future.

The next day, we enter the large modern building of Northwest Spine Surgeons. Two and a half hours later, I have been talked to, examined, and had x-rays taken in which my earrings and the braces on my teeth show up. I have watched a movie about another girl with scoliosis. I have been told that I am going to have surgery.

The news brings double emotions of shock and relief. I will wear a brace for a few months after surgery, but not for the years I had envisioned with dread. Surgery will fix my back in a matter of hours, whereas a brace worn for three years would merely stop my curve from progressing. Surgery appears the perfect solution, a blessing.

It is now a week before I leave to be "straightened out." I think that surgery is the best option for me, but when I think of it, my heart pounds. A scar down my back will be the sign that I have survived May ninth, the day I run from like a cornered mouse—and look forward to with hope.

Part II: Journal of My (Un)Twisted Spine

Fog in my head. A dull backache punctuated by tiny pinpricks of pain. Something important has just happened to me, I know, but I can't quite recall what it is. I blink.

I have changed my views drastically and learned so much. My teacher? A physical imperfection named scoliosis.

"Laura?" says a voice. "How do you feel? You were asleep for quite a while." "Mama," I mumble. My parents are standing over my bed along with a nurse. A nurse . . . that's it! I'm going to have back surgery! "It's Wednesday," Mom says. "Your surgery went great yesterday." "Oh," I say, confused. I close my eyes, nestle into my pillow, and let the fog take over.

It's Thursday. A man whose face I can't remember walks into my room carrying two pieces of white plastic Velcroed at the sides to form a clamshell that will mold to my body. My operation and the drugs I have been given have made me highly sensitive to noise. I put my hands over my ears as my dad discusses the features of my back brace with the brace maker.

Now, Saturday, all but a trace of morphine has exited my system. Unhooked from the IV that supplied the drug to my veins, I am clearheaded once more. I know that my back has been sliced open and that two steel rods have been attached to my newly straightened spine to hold it in place.

Today, I traded relatives. Early in the morning, my dad left for a clinic in Colorado Springs, while my little sister, Kelsey, flew down to Seattle by herself to be with my mom and me. She has a wonderful time being my private nurse. She's good at it, too, tucking blankets over my shoulders and giving me sips of ice water.

Later, I am alone in my room while my mom and Kelsey eat dinner, and two men in white medical coats walk in. They introduce themselves as x-ray technicians. Haven't there been enough pictures? What follows is one of my least favorite experiences of the whole ordeal. I am rolled onto a gurney and into a corridor filled with harsh lights and the crescendo and receding of voices. From my position, alone and flat on my back, everything seems twice as large, loud, and unfriendly. The hospital elevator becomes a cavernous chamber instead of a cramped cube.

In a room filled with the tones of country music, I am rolled onto a table below what I recognize as x-ray equipment. Then, with a hum, the whole table tilts upwards and I am left standing vertical, but upside down. I wish that I was back home, or at least in my quiet, comfortable room. Still, I am getting through this ordeal with no mom, dad, or sister for support.

I've spent my last night in the hospital. As I am pushed in a wheelchair out the front doors, I feel apprehensive. I am on my own. Within the hospital, I had nursing whenever I needed it. What if something goes wrong with me on the outside? I will be helpless.

Yet, as the confines of the hospital disappear behind me, I suddenly feel confident. I have just completed a major epoch in my life. I am proud of the scar on my back. ■

*Twelve-year-old **Laura Jacobsen** is in eighth grade at Blatchley Middle School in Sitka, Alaska. She enjoys reading and art and competes on the local swim team.*

FASCINATING CLASSICS

LORD JIM

by Joseph Conrad

Review by
Lesley Mackay & Charles Beckman

Lesley: Well, readers, it's exciting to be back at the beginning of a new academic year and a new round of ***Fascinating Classics.*** This year, our theme will be "Innocence and Experience." Our readings, in order, are *Lord Jim* by Joseph Conrad, *Middlemarch* by George Eliot, *The Mayor of Casterbridge* by Thomas Hardy, *Frankenstein* by Mary Shelley, and *Catcher in the Rye* by J.D. Salinger.

Charles: The theme of the passage from innocence to experience seems essential to Western literature. How people gain knowledge about the world is perhaps the novelist's greatest subject.

Lesley: In *Lord Jim*, Conrad takes on this topic in such a masculine way that I didn't like this book at first. I had to accept that its tale of sea-faring, adventure, honor, and betrayal was, in the writer's eyes, a story that was particularly about men. Then I could look for the novel's relevance and significance for me.

Charles: I, too, noticed the extreme masculinity of Conrad's world, best exemplified by the male crews on its ships, and clearly drawn from the author's extensive experience on French and British merchant vessels. When the hero gets married towards the end of the tale, his wife—a young Malay woman whom he renames Jewel—seems less human, less real than the book's other important characters. Relatedly, Conrad's writing sometimes betrays a crude approach to the other non-Europeans in his narrative.

Lesley: From our perspective almost at the end of the century, we can easily identify such problems in a work that was written in 1900. Still, for me, *Lord Jim* is a powerful story about getting older and about what it takes to get wiser. I think it's well worth exploring.

Charles: I agree, although in many ways the novel offers a harsh view of the transition from innocence to experience. I'm wondering, Lesley, do you accept Conrad's premise that the momentary weakness of a twenty-three-year-old can ruin the rest of his life?

Lesley: Before we think about that question, let's indulge in a little plot summary. The heart of this novel is found in an early scene of a terrible storm at sea. The young Jim (he is not Lord Jim yet) is part of a crew transporting one hundred and sixty Moslem passengers who are making a holy pilgrimage. While the passengers sleep below, the crew on deck is terrified by a storm so violent that it seems to rip the ship apart. The frantic sailors decide to save themselves and push away from the ship in a lifeboat, leaving their sleeping passengers behind.

Charles: One important irony is that the storm does not destroy the ship, named the *Patna*, after all. Its passengers are eventually rescued by another ship. All members of the disgraced *Patna* crew eventually make themselves scarce, except for Jim, who submits to the gruelling humiliation of a judicial inquiry into his moment of cowardice.

Lesley: Jim admits to abandoning ship in the face of peril, an act both so low and so human that other seamen can barely bring themselves to think about it. But the inquest does nothing to cleanse him of his sense of wrongdoing. Although no deaths ensued from his leap into the lifeboat, he is haunted by an unrelenting sense of personal failure.

Charles: So, let's get back to my question. Does this novel go overboard (pun intended) with its theory that the mistake of a very young man can ruin his life forever?

Lesley: My initial impression was that *Lord Jim* presented a very harsh and unforgiving view of how, in the world in which this novel is set, a moment of weakness could destroy a man's life. I found the narrative painfully bleak.

But as the story progressed, I realized that Conrad was making a much more subtle point: that it was Jim's character, not one great mistake, that put his well-being at risk.

Charles: Certainly, Jim does have imperfections that bring him grief. While his outer bearing is reassuringly unremarkable, inside he cherishes wild and vain dreams of heroism. Jim craves the glamour of a heroic moment; in contrast, the novel suggests that it is an unglamorous steadiness of character that makes for true nobility.

Lesley: Jim has a hard time understanding this, and the seafaring life he has chosen makes it no easier for him. Captain Marlow, the story's narrator, points out that the sea makes much of a young man's illusions, its surface reflecting and magnifying the fire in inexperienced eyes:

> *"There is such magnificent vagueness in the expectations that had driven each of us to sea, such a glorious indefiniteness, such a beautiful greed of adventures that are their own and only reward. What we get—well, we won't talk of that; but can one of us restrain a smile? In no other kind of life is the illusion more wide of reality—in no other is the beginning all illusion—the disenchantment more swift—the subjugation more complete."*

Charles: Readers of this column last year will remember that in *The Great Gatsby* F. Scott Fitzgerald provided a narrator who, while quite different from Gatsby, was also his hero's friend. Conrad uses the same technique in this novel. Jim's tale is told through the eyes of a sympathetic older sailor, Captain Marlow, who lets the reader see how moving Jim's story is for other seamen to contemplate. Marlow has contradictory views of Jim: sometimes he sees him as a regular guy, "one of us"; at other times, he views him as a peculiar and mysterious person.

Lesley: Jim's crime and his obsessive remorse about it strike a deep chord in Marlow, who is mature enough to know that all people have moments of weakness and, usually, memories that trouble them.

Charles: Marlow wants to help Jim start a whole new life. He knows that it will be tough for Jim to put his disgrace behind him, but he believes that Jim can do it, and he encourages him to find a favorable new situation. Jim works for a number of years in the lowly position of a messenger for shipping supply companies around the world. He makes a name for himself through excellent work, but continually runs away when he is confronted with something or someone associated, however loosely, with the *Patna* incident. He simply cannot face any reminder of his past.

Lesley: Here we bump into one of Conrad's most important and subtlest ideas. Although Jim's act of cowardice was obviously terrible and traumatic, the novel suggests that what really damages him is a second failure—his inability to let this mistake go.

Jim's self-destructive remorse is, in a way, cut from the same cloth as his vain, heroic fantasies in the beginning of the book. Both reveal too much concern over appearances and a desire for a spotless record that is at odds with the reality of human experience. Ironically, Jim doesn't change much as a result of his great error, although it literally transforms his life. He travels the world looking for a clean slate he can never have, failing to realize that he is a wiser person for his brush with failure and that he can move on.

Charles, do you feel that this portrait of Jim's second great error—his obsession over an earlier mistake—is realistic or unrealistic?

Charles: I think that Conrad is articulating a truth about human psychology: people are often haunted by the past in one way or another. But Jim's single-mindedness does seem a little over the top from my point of view: in real life, wouldn't he have gotten some perspective over time and gradually resolved his sense of guilt? Clearly, Conrad painted this novel in the accentuated colors of psychological realism rather than in the more muted tones of Realism.

Lesley: *Lord Jim* becomes even more vivid and its plot twists even more wrenching in its concluding chapters, which are set in the Indonesian archipelago. I don't want to spoil the exciting final chapters for readers who have not yet reached them, but you can expect pages full of intrigue, passion, and treachery as this novel comes to a close. I admire Conrad for his ability to blend a really original adventure story with an intense meditation on human frailties.

Charles: What's Jim doing in Indonesia? Well, he's taking his last and most extreme shot at starting again. He has been given a job at a remote trading post by an intriguing character named Stein, who is introduced quite late in the novel as a friend of Marlow's, a scholar, a gentleman, and an avid butterfly collector. Marlow goes to Stein for advice about Jim when he realizes that Jim may never achieve inner peace and that some kind of intervention is necessary in order to save him.

Lesley: This takes us back to the title, *Lord Jim*. When Jim resettles in his new and relatively primitive surroundings in Indonesia, he is accepted as a superior by the locals with whom he makes his new life; they give him the dignifying title of "Lord." Jim is treated warmly by the old chief of his new community and becomes fast friends with the chief's only son. Finally, he has found the acceptance and the community that he lost years ago when he jumped ship.

Charles: But does he have true peace of mind? By this point in the novel, we readers realize Jim's main problem is that he relentlessly persecutes himself and holds himself apart from the people around him. The gripping end of this adventure story is tightly interwoven with the question of whether Jim has finally let go of his imperfect past and is really capable of acting in league with others.

Conrad alludes to this as the problem of being a "straggler." Ever since Jim's ignominious jump, he has allowed his terrible sensitivity to his mistake to isolate him. In his eyes, he is a special case, a unique being, marked forever.

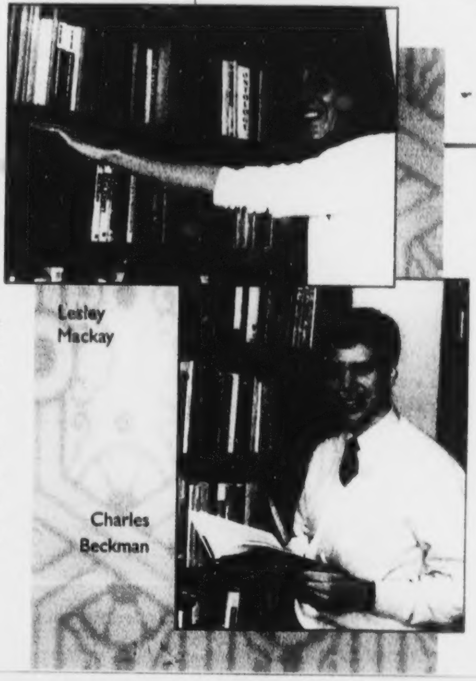
Lesley: Readers will have to discover for themselves whether Jim is finally able to free himself from his obsession. But an important hint is provided by the intriguing character of the compassionate Mr. Stein. Stein is in love with butterflies because of their fragile beauty and, especially, because of the magnificence of the rare perfect specimen.

Stein brings his romantic sensibility to his dealings with human beings, too. But, as he says in the novel's most famous line, "Man is amazing, but he is not a masterpiece." Stein understands that Jim is driven by unattainable desires to perfect himself or to seem perfect in the eyes of others, to be like the rare flawless butterfly. What can be done for a person like this?

Charles: It's hard to avoid agreeing with Stein that man is not a masterpiece. So much evidence of this surrounds us. But Conrad seems especially interested in the ironic contrast between a man's real nature and his inner perfectionistic strivings. The novel implies that each person has to make sense of this disparity for him- or herself.

It's important to point out that Conrad does not make fun of his hero. While revealing Jim's hopeless desire to be a perfect specimen, he also does a remarkable job of getting the reader to identify with Jim. As Marlow and the other sailors see themselves in Jim's cowardly leap from a ship he thought would sink, readers are likely to identify with Jim's longing to stand out from the crowd, to be free of ordinary weakness.

Lesley: One thing that certainly stands out about this novel is its brilliant writing, which blends sensitive, evocative language with powerful insights into human nature. Making this achievement even more impressive is the fact that English was Conrad's third language—after French and his native Polish. Reading this finely crafted work, one realizes that Conrad must have felt the same desires for perfection that he attributes to his hero. ■



Don't forget to read George Eliot's *Middlemarch*, the next book in this year's series. It's a long one, so get started today!

***Lesley Mackay**, who holds a B.A. from the College of William and Mary and an M.A. in English from Indiana University, is CTY's Staff Writer.*

***Charles Beckman** holds a B.A. from Penn State and an M.A. from the Writing Seminars at The Johns Hopkins University. He is an Assistant Director of Academic Programs at CTY.*

Harvard, profiled in this issue, always wins rave reviews. But it's not the best place for everyone. This young author offers worthwhile advice for students contemplating their college choice: "Be true to yourself."

VERITAS?

by Megan Moore

S*pring 1994:* The letter came, and I cried. The cream watermarked paper, the perfect crimson and black shields in the upper-left corner, the precise, respectful English, and the calligraphied name all made me flush and turn away.

For seven out of eight people who had applied for a place in the class of 1998 at Harvard and Radcliffe, this was the understandable and expected reaction. They were being denied admission to one of the most prestigious institutions of higher learning in the world. They would never have a chance to live in Harvard Yard, to cheer for the Crimson at a Harvard-Yale game, or to graduate with the coveted degree. The ivy-covered gates to Harvard glory had been slammed shut in their faces.

But I was the lucky one of eight, as I had just been reminded four months after receiving an exultant acceptance letter. I had applied early and been accepted; and now, although I held the beautiful "Certificate of Admission" in my left hand, I knew that I was not going to Harvard. I had quietly, thoughtfully, and confidently turned away from the brick grandeur of the Yard, stepped along the snowy footpaths that criss-cross it, and closed those ivy-covered gates behind me. I had chosen another path.

And still I cried. I had honestly wanted to love Harvard. What else could have been the perfect ending to four perfect years of high school? Sending in a deposit to the luminous Cambridge, Massachusetts, university would have been the thick icing on a cake baked diligently with just the right mix of grades, test scores, sports, service, interviews, essays, and luck. In going to Harvard, I would be living the American Dream—a fairy tale for the hard-working middle-class teenager granted the opportunity to rub elbows in the library and in the Freshman Union with the rich, the famous, and the oh-so intelligent.

My parents, my grandparents, my aunts and uncles and cousins and neighbors and former babysitters would all be able to say those two weighty syllables—*Har-vard*—with the pride, prestige, and amazement dripping from their tongues and splattering all over awed and jealous acquaintances. And I would finally be able to prove to myself, and to others, that I had made it, that I was worth something, and that I was ready to make my mark on my world.

I had arrived alone in Cambridge on a snowy March morning a month earlier, an accepted pre-frosh with an overstuffed suitcase and high hopes for the community that was perhaps to be my four-year home. It was too early to go to the room of the friend I was to stay with, so I took off my coat, gloves, and scarf, and settled down in a café in Harvard Square. Over steamy hot chocolate, I peered out at the awaking university.

Early-rising students (I assumed they were students, distinguished by their crimson scarves and backpacks) rushed about alone or in pairs to grab coffee or a bagel, head to a workout, or pick up the morning paper. Solemn adults in dark overcoats carried leather briefcases (filled with students' papers? research proposals?) and hurried across icy intersections, green light or not. A homeless man, layered in the frayed multi-hued leftovers of a materialistic society, pushed a shopping cart brimming with odd objects gleaned from months of roaming the quirky alleys of Cambridge. Steam gushed out of street grates and crept along sidewalks, licking at the grayish crust hardening on snowplowed drifts and tumbling into slushy brown puddles. The students, the professors, the businessmen, the storekeepers, the indigent . . . and me. Sixteen years old, naive and idealistic, I had been accepted to Harvard and felt very much alone.

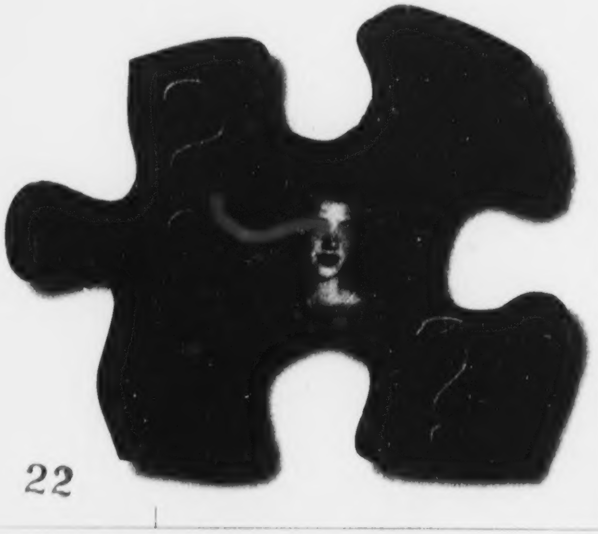
Everyone I met told me that it was going to be a shock but that I would adjust to everything—the academic pressure and expectations, the initial sense of confusion and bewilderment, the anonymity of the lecture hall, and the isolation of the large university—and that I would be forever thankful for four years of incredible opportunities and challenges.

It sounded perfect, but something felt wrong. The first, and then the second, and then the third day went by as I felt the experience slipping away from me—the bundled rushing with averted eyes, the snoozing in packed lecture halls with microphoned professors, the routine comings and goings of one speck among thousands.

I was not Harvard. Harvard was not me. And as much as I had hoped for it—for the match, the fit, the sense of euphoria, the *Eureka!* of having found an intellectual and social home—it was not going to happen. Being accepted to Harvard, I had felt confident and important. At Harvard, I felt alone, scared, and confused. I read an article in the *Radcliffe Quarterly* in which the freshman author wrote that initially it was a lot nicer to have been able to tell people back home that she was going to Harvard than to actually be there. I was terrified. I was not going to let myself go to Harvard.

So I chose a college that felt like me, like a home, like a place where I wanted to spend some of the most important years of my life, around people I wanted to emulate and with whom I wanted to swim, talk, study, and become friends.

In choosing a college that had been ranked in recent years as the top small liberal arts college in the nation, I knew I was sacrificing nothing academically. I gave up large lectures and teaching assistants for seminars and interaction with my professors, and I sacrificed the diversity and excitement of a metropolis for the serenity and community of a tiny town in the Berkshire Mountains. I gave up the opportunity to meet ten new people a day, for



. . . I chose a college that felt like me, like a home, like a place where I wanted to spend some of the most important years of my life, around people I wanted to emulate and with whom I wanted to swim, talk, study, and become friends.

the chance to say hello to ten people on the way to class each morning and to have them wave back and know my name. I traded city air for country air, although I suppose snow is the same everywhere. But most of all, I gave up misgivings for confidence.

I felt happy. Excited. Relieved. My first year at college was not going to be a strain, a difficult adjustment, a necessary evil. It was going to be glorious.

My reception at home was less than glorious. A few people were thoughtful and showed interest in this small mystery college. Yet far more did little to mask their shock, disappointment, and uppity feelings of betrayal at my having stupidly snubbed the Ivy League (for no less than one of the three Little Ivies, if they had bothered to look it up) for my own selfish reasons.

One of my closest friends took it personally, asking me if I had really thought about it (yes, nonstop for several months) and if I had discussed it with my parents (yes, into the wee hours of the morning countless times, with their endless support and relief at my final decision). When she said she was "disappointed" in me, I exploded.

I was not making the most important decision of my high school life with the egos and vicarious emotions of friends in mind. I had the mental and personal qualities to make it into Harvard; did I not now have the maturity and strength of character to be trusted with the decision as to whether or not I wanted to go there?

The more the integrity and validity of my decision and the worth of my judgment were called into question, the more frustrated and emotional I became. No one appreciated the hundreds of hours of research I had done; no one appreciated the days I had spent staying up late in dorms talking to students and reading through course catalogues and student newspapers; no one had counted the professors, admissions officers, and alumni to whom I had spoken. Harvard was different. Being accepted to Harvard meant giving up my freedom of choice. Suddenly my future was community property.

Eventually, after many heated arguments and my desperate but hopeless attempts at explaining, the people around me gave up—or perhaps took a little time to listen and think and look beyond the name. And I was allowed to relax, celebrate, and look ahead.

I can now sleep easily and daydream freely, knowing that I chose a college for all the reasons that are right for me. So maybe I'm not into the fast track, I'm not into cities, and I'm not into prestige for the sake of prestige. But now I know what really is important to me—community, ideas, and people with integrity, passion, and compassion.

I've stashed away that beautiful Harvard "Certificate of Admission" in a file folder somewhere, and I'll take it out to look at again when I graduate from my college. To smile and see how much I've changed, and how much I'm still me.

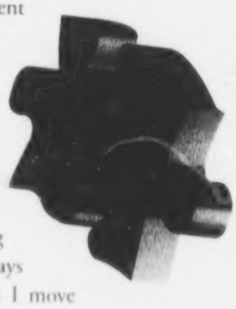
*****

Summer 1995: It's over a year since I wrote this essay. In rereading it after completing my freshman year at Williams, I am surprised at how much it still rings true.

Yes, it does get awfully quiet out there in the mountains of western Massachusetts, and yes, I do get pretty tired of explaining to people in California that Williams is not William and Mary and that it is not a women's college. But no, I would not have traded my experience there for anything.

Last year, I lived in an intensely beautiful place with more trees and hills and stars than I had ever seen before. And I studied, swam, and had a great deal of fun with wonderful people of integrity, passion, and compassion. My professors waved to me on the small streets of Williamstown, and I never walked across campus without seeing a friend. Williams became my home. My classmates became my friends; my friends, my family.

Cambridge is only a few hours away, a long bus ride with plenty of time for reflection. Several times last year I ventured into the city to visit friends at Harvard—to experience the hubbub and excitement of Harvard Square, to see new faces, and to feel the rush of energy buzzing around such an intense and intellectual place. Harvard and other big universities will always be out there, and as I move through my undergraduate years and toward graduate or professional schools, my future may very likely include them. I look forward to that adventure.



Yet for today, and for these next three years, I will be breathing small-town country air. While I was busy and happy and delighted on my weekend visits to Cambridge, I always smiled as the bus passed hills and cow pastures and rounded the corner onto Route 2 into Williamstown. I was coming home. ■

Now a sophomore at Williams College, ***Megan Moore*** ***is pursuing a double major in American Studies and biology. She'd be happy to talk about her experiences with other students making college decisions; her e-mail address is 8mmm@williams.edu.***

STUDENTS REVIEW

HARVARD

College Review Series

This on-going series is intended to aid prospective college students in their search by offering insiders' views of selected colleges and universities, as expressed by current undergraduates or recent graduates who have exceptionally high academic ability. Our reviewers all share high expectations for a college's academic standards and its nurturance of emerging talent.

Note that the number of student reviewers is small. Consider their personal perspectives as only one component while you gather factual information and impressions from such other sources as college catalogues, site visits, talks with officials and students on campus, and the advice of your guidance counselor and teachers.

Harvard and Radcliffe Colleges

Our reviewers include 28 students, who major(ed) in art history (1), biochemistry (6), chemistry (1), computer science (1), English (3), government (1), history (1), math (9), philosophy (1), physics (4), and social studies (4). (The number of majors exceeds 28 because several students have double majors.) Students' comments appear within quotation marks.

Quality of Academic Instruction for Undergraduates

Reviewers enthusiastically praised the education Harvard delivers, although evaluations of the 'core' curriculum tended to be critical.

"Unparalleled, to my knowledge. You must take the initiative, but if you do, the resources are enormously deep and wide. The core is poorly designed, but the education is otherwise first-rate."

*"Academic resources are **summa.** I had a few really spectacular courses that posed lines of inquiry I had never considered before. The faculty are very accessible. More than one prof has exhorted students at midterm to come to office hours because he had seen so few of them there. With planning, 75% of the core courses one takes can be 'real' classes, not pale specters. (Hint: If you take a crazy elective, the prof who offers it probably really wants to teach it.)"*

*"The academic resources are formidable. Professors not only are leaders in their fields but are often **creating** their fields. If there is a drawback to this virtue, it is that Harvard is primarily a research institution. With few exceptions, the faculty place teaching second on their priority list. Don't get me wrong; if you go out of your way to see teachers during office hours, are careful about choosing courses with profs known to love teaching, and take advantage of the resources at Harvard's disposal, you'll have a fantastic academic experience."*

"Choose profs carefully; they are more important than the course material. Faculty are accessible if you make the effort; however, it is neither necessary nor considerate to demand that a Nobel laureate answer your questions on, say, elementary quantum mechanics. The TAs are generally excellent."

"Like most things at Harvard, the quality of instruction a student receives depends entirely on the anount of initiative the student takes. All the faculty I have encountered seem genuinely interested in connecting with students outside of class; and the opportunity for one-on-one tutorials in one's concentration guarantees that those who wish it can receive ample personal attention. However, it would be entirely possible for a retiring student to avoid direct contact with profs. The two week 'shopping period' in the beginning of the semester, when students freely float between 'Intro to Bio' and 'Major British Writers' before registering for courses, gives students the chance to 'sample before buying.' Choosing courses, professors, and tutorials is an exciting responsibility."

"The libraries are simply amazing; only the Library of Congress tops Harvard's holdings. On the other hand, computers and labs for the natural sciences seem to be wanting in quality. If your interest lies in these areas, try to work with a prof on a research project, to gain access to cutting edge technology."

*"Harvard's two-week Reading and Finals Period allows for tremendous exam preparation—and motivates profs to give very difficult exams! Profs almost always ask some questions on finals that force the student to extend the course material to solve new types of problems that have not previously been covered. Knowing that finals would be demanding helped to motivate me both to learn and to really **think** about the material."*

"One of the best reasons to choose Harvard is its emphasis on teaching students how to think. The core is intended not to teach students every fact in a given field, but rather to teach the modes of analysis used in historical studies, science, literature, art. The core is, however, merely the tip of the proverbial iceberg of thousands (yes, thousands!) of course offerings. Whether pursuing advanced graduate courses in one's concentration or taking a course purely for interest's sake, one can find academic happiness here. You can't go wrong attending Harvard if a solid liberal arts background is your goal."

"The core is poor—an eclectic collection of topical courses that focus on approaches to knowledge in a variety of subjects. It does not provide a student with much knowledge of the history of Western civilization, its ideals, or its philosophical underpinnings. You can complete Harvard's core without ever reading Shakespeare, Homer, or any of many other great thinkers."

*"The '**B** to **A** minus' grading system is based on not letting our egos deflate. If you don't do much work, you get a **B**; if you really goof off, you can get a lower grade. However, to get an **A**, the amount of additional work is enormous."*

Social Life

Reviewers were unanimous in their praise of the vibrant extracurricular life at Harvard.

"The housing system is outstanding; it's one of the things I liked most about Harvard. Freshmen start out in the communal atmosphere of the Harvard Yard dorms. At the end of freshman year, students select one of the residential Houses, where they live for the remainder of their undergraduate careers. The Houses all have different reputations (from geekish to artsy to partyish to snobbish to none at all), so students have a chance to join the residential community in which they will feel the most comfortable. The 200-350 students in each House all eat in the House dining hall, which leads to the development of lots of wonderful friendships."

"Great location. Harvard Square is filled with shops, restaurants, and almost anything else you would need. The superb public trans-

portation system gives students access to a plethora of cultural and athletic events. The Boston area is filled with colleges, which lends an aura of youthful exuberance to the city."

*"**Extraordinary** opportunities in music and drama, transcending any I've seen at comparable institutions (not including music or drama schools, of course). Were you to make the effort, you could see a Harvard play or musical on almost any day of the year."*

"The social life is not rollicking; it's more often scholarly, warm, and deeply rewarding. Most social circles are very academically oriented. You learn more from your friends than from your professors at times."

"Harvard students are, nearly without exception, over-committed and proud of it. To succeed in extracurriculars in a school filled with team captains, newspaper editors, and accomplished writers requires drive. But if one is willing to do some work, the experience is incredible. That drive is the key to the 'electricity' on campus."

What Do You Like Best about Harvard-Radcliffe?

"Most of all, the students are fantastic—the most brilliant and exciting group I'll ever meet (at least in such numbers). Enjoy them rather than being daunted. They're why you should go to Harvard."

"First and foremost, the people. Almost anyone you meet at Harvard is very intelligent and has interesting things to say about many different issues. Also, due to the emphasis in admissions on selecting many students whose achievements are highly developed in very specific areas, you meet more unique, truly memorable people at Harvard than at any other college."

"The vibrant intellectual community. There are so many opportunities to indulge sesquipedalian tendencies without turning heads. You can talk about things other than how the Sox are doing. What a relief after high school!"

"A sense of professionalism and competence abounds. I have enjoyed the opportunity to discuss my areas of interest with students who have different perspectives and interests but comparable expertise."

"The unparalleled breadth and depth of Harvard's resources. The awareness of having the world's premier library at one's beck and call is just a part of the we-make-history-here feeling of the place. The living traditions of Harvard's past and the classy, classic feel of the Yard and the Square. The respect shown to students and the College's tolerance of youthful excesses are also much appreciated."

What Do You Like Least about Harvard-Radcliffe?

"There is very little guidance. It's easy to slip through the cracks or let opportunities pass by (without even finding out about them) because Harvard is so large and disorganized (like the real world, but richer and smarter). This is a place for those who can fend for themselves and want to work with top scholars, not for those who need academic counseling."

HARVARD AND RADCLIFFE COLLEGES
Cambridge, MA 02138
(617) 495-1551

- 4-year private coed university
- Historic campus in greater Boston
- Full-time undergraduate enrollment 1994-95: 3,691 men; 2,879 women.
- Special features: The second most extensive library holdings in the nation, numerous art museums (Fogg, Sackler, Busch-Reisinger) and endowed centers (Center for Byzantine Studies in Washington, DC, Center for Study of the Italian Renaissance in Florence, Italy), cross-registration with MIT.

*"The fact that Harvard **is** so huge and full of opportunity. While this is certainly one of its greatest advantages, it can also be bewildering. It's been easy for me to spread myself too thin."*

"The core is an obstacle rather than an enrichment. Distribution requirements would be better, with flexibility to take 'real' (upper level) courses towards those requirements."

*"Other than the intense competition—and it truly **is** intense (especially if you have a concentration with a lot of pre-meds in it)—Harvard simply needs more tennis courts!"*

Who Would Be Most Compatible with the Academic and Social Atmosphere at Harvard-Radcliffe?

"Someone ready for the fast lane!"

"Someone confident in his/her own abilities and able to appreciate and respect ability in others."

*"Someone who has a strong sense of self-esteem. This does not mean obnoxious or cocky. Unless you're a **really** exceptional talent, you're going to find people at Harvard—maybe even a lot of people—who are better than you at anything you've ever tried. Adjusting to this fact can be the most difficult task a Harvard freshman faces."*

"Highly motivated. Everyone at Harvard feels he/she truly excels at something; in order to stay sane, one needs to feel the same way."

*"It helps to be devoted to a particular pursuit before Freshman Week. While it is possible to do almost anything here, it is difficult to take up something new because of the competition in **everything** extracurricular."*

"Students with a very strong sense of self-worth and of their goals and values; students with a powerful intelligence, prepared to work harder than they ever have and still not do as well as they did in the past."

If You Had It to Do over Again, Would You Go to Harvard-Radcliffe?

All respondents said yes, two with reservations.

"Yes. Instructors are replaceable, but the Harvard student body is hard to duplicate anywhere."

*"Yes! I love it. It **is** academically challenging and thus often frustrating for a student who is accustomed to getting straight As; however, the struggle is a character-building one, and the social experiences are fantastic."*

"Absolutely. Carping aside, there's still nowhere else that comes close to the majesty of the place, the musty history behind each desk, the feeling that the John Harvard statue is the reference point for all American education."

"Definitely. Harvard's a very exciting place to be a student—there's an energy that shows in everyone. It's thrilling to be a part of it."

"If you're not planning to major in science or some other field where you need very modern facilities, consider going to a small college. Harvard is exciting and great, but I often long for the student-teacher relationships I hear about from friends at smaller schools."

As you try to find the college or university best suited to you, the views of Harvard presented above may be helpful. Keep in mind that these students might have had similar positive or negative experiences had they attended a different university. At any college, it is important for the individual student to seek out challenging academic experiences and the best professors and to create a social life that best fits his or her personal style. ■

Note: The students quoted in the College Review Series are expressing their own views, which are not necessarily those of JHU or CTY.

CREATIVE MINDS
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JOURNAL OF MY TWISTED SPINE

by Laura Jacobsen

As I write, I can't believe how much has happened in the last two months. The time has flown by on silver, streamlined wings, yet the beginning seems so long ago. I have changed my views drastically and learned so much. My teacher? A physical imperfection named scoliosis. It all started one day when my mom knocked at my bedroom door.

Part I

I am lying on the floor, stumped for a moment in a story I am writing. "You know how one of your shoulders is higher than the other?" she asks. I nod. Someone pointed that out to me once, but it's hardly noticeable. "That is one of the signs of scoliosis," she says. "Do you know what that is?"

A lump of lead takes the place of my heart. My head suddenly feels dull, my ears hum, and a wave of heat washes over me. I know what scoliosis is, all right—a curvature of the spine that afflicts the bodies mainly of teenaged girls. I recently read a book in which the main character, a ballerina about my age, had to wear a back brace for several years when her dance teacher spotted the signs.

My mom starts talking of x-rays and of going to Seattle for a brace fitting. How can she be so casual when the worst thing of my life is happening? I nod like a marionette on a string. She finally leaves the room.

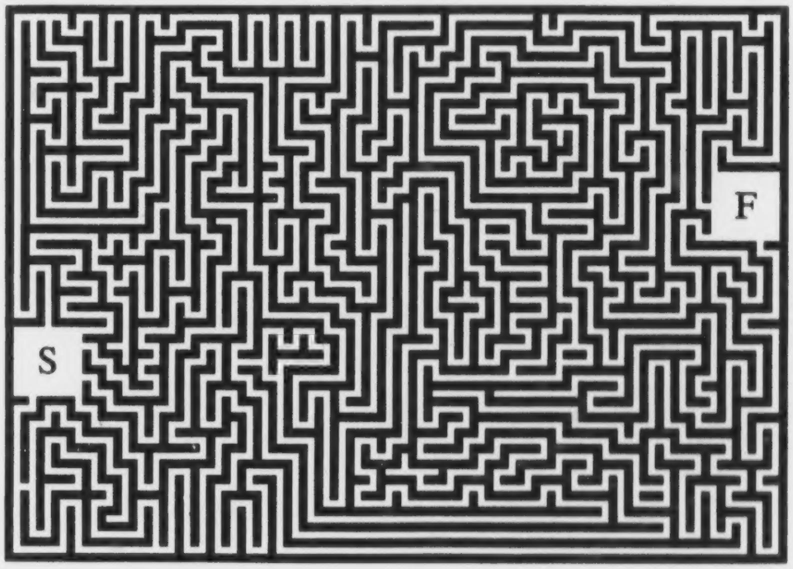
I look again at my story. My main character, whom I have carefully invented to be as vivid as a real person, now seems silly and superficial. She does not have to wear a hard casing that encloses her body like a cage.

(continued on p. 17)

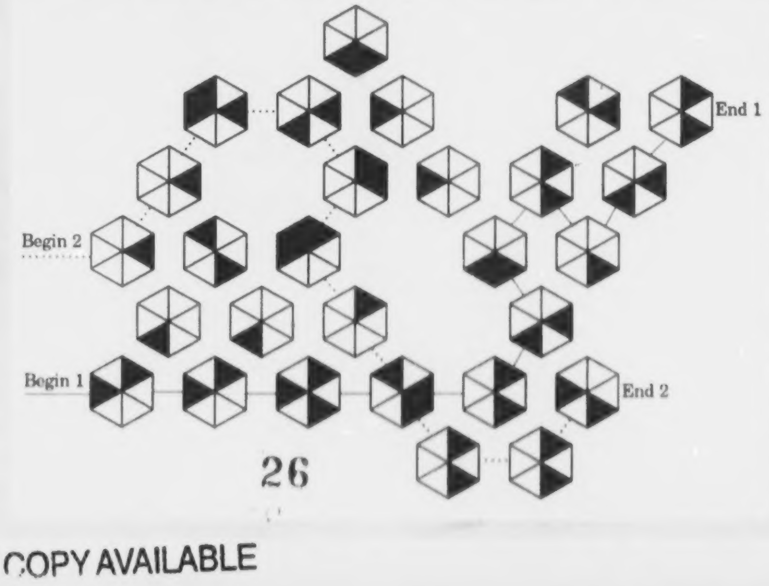
*Fascinated by mazes and puzzles, **Tim Boester** is also intrigued by roller coaster design. Tim is a sophomore at the University of Chicago, where he is studying physics and math.*

MORE PUZZLES

by Tim Boester



SOLUTION TO PUZZLE IN MAY/JUNE ISSUE OF IMAGINE.



VOLUME 3 • NUMBER 2

Opportunities and Resources for Academically Talented Youth

November/December 1995

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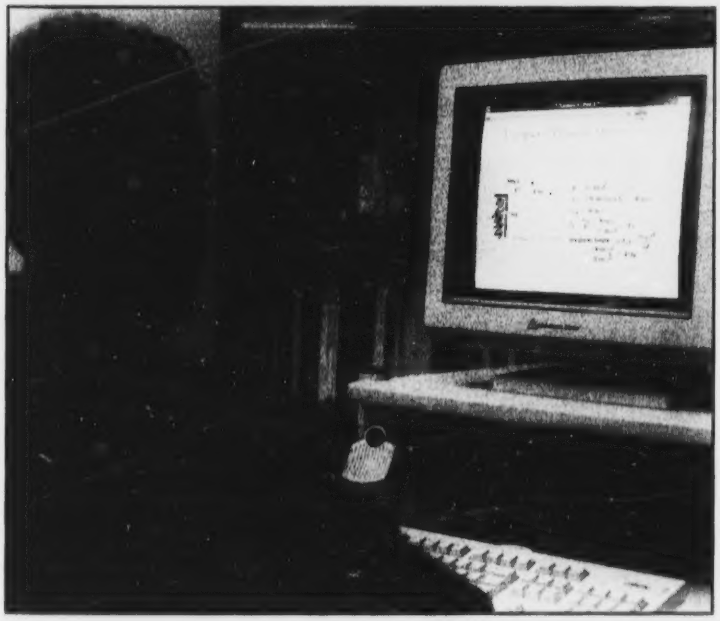
Spotlight On

ACCESSING DISTANCE LEARNING



A student learns physics, using the interactive Distance Learning Project tutorial (see p. 5)

Judging by the buzz among educators today, you'd think that "distance learning" was a brand new concept. In fact, distance learning has existed ever since the first time an isolated student struck up a correspondence with a sympathetic mentor. The value of the educational exchange between them—imparting information, experience, and advice, sharing dreams and plans—depended as much upon the quality of their human interaction as upon the actual knowledge transmitted in their letters.

Distance learning has come a long way since that ancient time, expanding from mail to radio and television broadcasts to the global computer network. The daily proliferation of available options is truly mind boggling, and innovations appear so quickly that it's hard to keep up. Today's Information Highway is literally changing the nature of "distance" and the face of education itself.

In this issue of *Imagine*, we describe just a few of the many opportunities available in distance learning formats today—and examine some of the different ways in which technology and teachers can and do interact to facilitate the student's intellectual development. ■

Mark Your Calendar

. . . with these January-February registration deadlines for selected academic competitions.

DEADLINE	COMPETITION
January—February	**JETS-TEAMS Competition** (Schools may enter multiple varsity teams, grades 9-12, and jr. varsity teams, grades 9-11; *call for local registration deadline and space availability*): Daniel Eagle Eye, Junior Engineering Technical Society, 1420 King Street, Alexandria, VA 22314-2794; (703) 548-5387, fax (703) 548-0769, e-mail: jets@nas.edu; home page: http://www.asee.org/external/jets
January 5 & February 28	**Knowledge Master Open—Elementary** (Schools enter one team, grades 5 and 6): Academic Hallmarks, Box 998, Durango, CO 81302; (800) 321-9218. *[Grades 7-12 register April 1.]*
January 12	**Duracell/NSTA Scholarship Competition** (Students enter individual original projects, grades 9-12): National Science Teachers Association, 1840 Wilson Boulevard, Arlington, VA 22201-3000; (703) 243-7100.
January 15	**American High School Mathematics Exam/AHSME** (Schools register, up to grade 12; those registering after Jan. 15 pay higher fee): Dr. Walter E. Mientka, American Mathematics Competitions, Department of Mathematics and Statistics, University of Nebraska, 1740 Vine Street, Lincoln, NE 68588-0658; (402) 472-2257, fax (402) 472-6087.
January 23	**NCTE Achievement Awards in Writing** (Teachers nominate students in grade 11): National Council of Teachers of English, Achievement Awards in Writing, 1111 W. Kenyon Road, Urbana, IL 61801-1096; (217) 328-3870.
February 1	**Toshiba/NSTA ExploraVision Awards Program** (Teachers and community advisors register student teams, grades K-12): National Science Teachers Association, 1840 Wilson Boulevard, Arlington, VA 22201-3000; (800) EXPLOR-9.
February 5	**Quill & Scroll Society International Writing and Photography Contest** (Individuals enter, grades 7-12): School of Journalism, University of Iowa, Iowa City, IA 52242; (319) 335-5795.
February 9	**National Peace Essay Contest** (Students enter with adult contest coordinator, grades 9-12): United States Institute of Peace, 1550 M Street, NW, Suite 700, Washington, DC 20005-1708; (202) 429-3846; e-mail: heather_kerr@usip.org
February 9-15	**USA Computing Olympiad Qualifying Round** (Individuals enter through local coordinator): Dr. Donald Piele, University of Wisconsin-Parkside, P.O. Box 085664, Racine, WI 53408; (414) 634-0868; e-mail: piele@cs.uwp.edu; Web site: http://usaco.uwp.edu/
February 20	**National Federation of Press Women High School Journalism Contest** (Individuals enter, grades 9-12): NFPW Headquarters Office, 4510 West 89th Street, Suite 110, Prairie Village, KS 66207; (913) 341-0165.
Other	**National Spelling Bee,** run by Scripps-Howard, Inc. Students enter only through a sponsoring newspaper; check with your local press to see if they participate.

Correction: After the September/October issue went to press, we learned that the Foundation for Scholastic Achievement had decided not to run the **National Academic Team Challenge** series during this academic year. Following a move and restructuring, they plan to have new brochures available in the spring which will describe next year's competitions. For information, write to Foundation for Scholastic Achievement, P.O. Box 3340, Iowa City, IA 52244; (312) 464-4812.

CTY is Growing!

The Center for Talented Youth has been officially reframed as the Johns Hopkins University **Institute for the Academic Advancement of Youth (IAAY)**, with CTY as a component of IAAY. While the organizational structure has expanded, our mission remains the same: to identify, nurture, and develop academic talent among precollege students.

Imagine...
*Opportunities and Resources for Academically Talented Youth**

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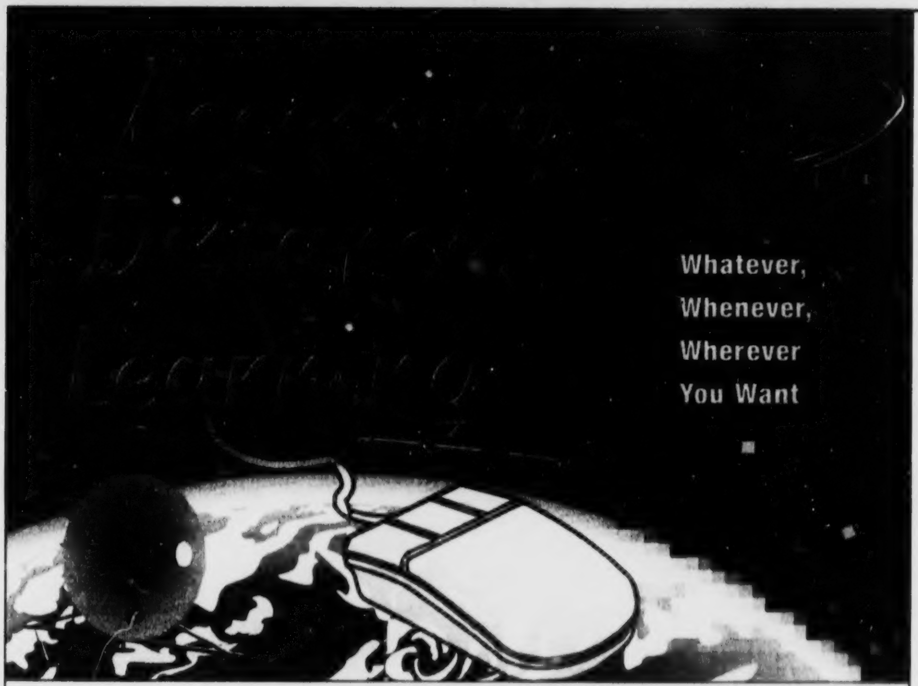


Whatever, Whenever, Wherever You Want

- *"By accelerating, I've completed all the science and math courses my high school has to offer, but still have to finish two years of humanities requirements before I can graduate. I have an hour and a half free in my school schedule. What can I do to keep growing in science and math?"*

- *"We live in an isolated area where educational resources are very limited. My school doesn't offer AP or honors courses, and I don't feel challenged intellectually. I've heard about distance learning courses, but need to know how to choose a program that will really be worthwhile for me. What are my options?"*

- *"I've always loved creative writing, but my school's writing courses focus primarily on review of vocabulary and grammar. Where can I find something that will help me expand my writing skills?"*

Why Distance Learning?

For students who are highly talented academically, the traditional demarcations between middle and high school and between high school and college tend to blur.

Maybe you have accelerated in one or more areas and require additional coursework outside the traditional precollege curriculum. Perhaps you're looking for greater intellectual stimulation, for broader or deeper understanding of a particular subject. Or you may want to compress your high school and college years in order to save on college tuition and advance more quickly into graduate school. Distance learning may be just what you're looking for.

What is Distance Learning?

In its basic definition, distance learning can refer to any educational situation in which teacher and student are not engaged face to face.

Up until the middle of this century, distance learning meant correspondence courses transmitted on paper via the postal service. Then radio and television enabled teachers to broadcast to larger audiences. But homework and exams still required the use of paper and mail.

However, within the past five years, these options—although still available—have been speedily overtaken by an explosion in the world of communications technology: the global computer network, satellite links, interactive virtual classrooms, electronic bulletin boards, on-line libraries, CD-ROMs, e-mail, fax machines—and the list goes on. Indisputably, the way we learn and work—the way we *live*—is being transformed.

Who Should Use Distance Learning?

Like any format that involves independent study, distance learning can most benefit a certain type of learner. So take a look at yourself—up close and personal—before you leap.

- *Are you a self-starter?* To get the most out of distance learning, you need to be motivated, intellectually curious, and disciplined enough to work consistently on your own. The tendency to procrastinate is natural in most of us; it's how you handle that tendency that makes the difference.
- *Do you really have the time?* Most academically talented students are already heavily engaged in curricular and extracurricular activities. If you are considering a distance learning program outside your regular academic activities, ask yourself one important question: Can you realistically fit this extra work into your daily schedule, or are you apt to fall behind, become frustrated, and lose interest?
- *Can you afford it?* At the most basic level, you need to consider the cost of tuition and textbooks/materials. High-tech transmission requires sophisticated computer equipment and on-line time. Having your own system is most convenient, of course, but not yet an option for everyone. Educators, concerned about the political/moral issue of equity of access for all students, are pushing to make distance learning technology more available in schools and libraries.

Still Interested? Then Read On . . .

Two defining characteristics of distance learning are that (1) it transcends the constraints of time and space, and (2) is student focused. You're in charge: you choose *when, where, what,* and *how* to learn.

- *When:* No bell dictates when you begin or when you end. Since you're not tied to a particular classroom/teacher/class period, the time you set aside for this coursework can be flexible. Early bird or night owl, you learn when it's convenient for you.
- *Where:* Whether you live on an isolated island off the coast of Maine, on a farm in Nebraska fifty miles from the nearest town, or way out in the Alaskan wilderness, you can still be "on campus" at the flick of a switch. In fact, distance education is becoming the delivery model of choice for many school districts whose students are widely separated or homebound for any reason.
- *What:* You choose the program that accommodates your own educational goals. The world is your oyster—actually, an enormous bed of oysters, each containing pearls. Select non-credit enrichment courses, or earn credit for GED programs and

precollege/college/university/continuing education courses.

You can accelerate your school learning or go beyond what your high school offers—completing advanced work in, say, math, Latin, or writing that would otherwise be put off until college. And you can access literally thousands of options that are not available in a standard high school curriculum—Arabic, History of Soviet Russia, and Writing the Nonfiction Book, to name just three.

■ *How:* With all the distance learning options available today, you can choose a format that suits your own learning style and your financial and technical resources.

Then, you learn at your own pace. In interactive programs, the computer or human instructor will advance you past the stuff you already know or can grasp quickly. If you hit a snag, you will stay at the sticking point until you fully understand it.

Long Distance Learning Relationships

Just because you're learning independently doesn't mean that you're alone. Good distance learning experiences, regardless of format, provide a real human being at the other end—someone who is trained not only in the material you're studying, but also in the most effective use of the delivery model you've chosen.

If you can link into a community of other distance learners, you may also be able to get to know some of your classmates. They will likely be interested in sharing the learning experience with you, too. And you never know: you might have more interests in common with a classmate six states away than with the boy or girl next door. It's all part of the satisfaction that can be yours when distance is no object in your learning. ■

SELECTED DISTANCE LEARNING OPTIONS

Available by Mail and Computer Technology

These distance learning programs offer high school courses/degrees accredited by their state or region, as well as for-credit undergraduate courses from the university's curriculum. Transfer of such credits is dependent upon the approval of the receiving institution. A wide variety of enrichment and Continuing Education courses is also available. Call for catalogues, and inquire also about newly developed on-line courses.

University of California Extension

Through this extensive program, you may correspond with your instructor for high school, university, and professional development courses by mail, e-mail, or fax.

Center for Media and Independent Learning, University of California Extension, 2000 Center Street, Suite 400, Berkeley, CA 94704; (510) 642-4124; e-mail: cmil@violet.berkeley.edu

University of Wisconsin-Extension

You may choose from hundreds of high school and university correspondence courses, and enroll at any time during the year. Keeping in touch with your assigned instructor by mail or e-mail, you work at your own pace, taking up to twelve months to complete coursework and exams.

UW-Extension, Independent Study, 104 Extension Building, 432 North Lake Street, Madison, WI 53706-1498; (800) 442-6460, fax (608) 262-4096.

Penn State Independent Learning

Penn State uses both traditional and nontraditional methods to bring any subject offered through its colleges directly to you. An academic advisor is available to assist you in choosing from over 300 credit and noncredit courses. Your assigned instructor communicates with you by mail and telephone.

Independent Learning Program, The Pennsylvania State University, 207 Mitchell Building, University Park, PA 16802-3601; (800) 252-3592 or (814) 865-5403.

University of Nebraska-Lincoln Independent Study High School

Staff members in the Department of Distance Education examine your educational needs before choosing the most appropriate course delivery system for you: print-based independent study, videotape, satellite, microwave, or face-to-face instruction.

Department of Distance Education, Division of Continuing Studies, Clifford Hardin Nebraska Center for Continuing Education, Room 269, 33rd & Holdrege Streets, Lincoln, NE 68583-9800; (402) 472-4321, fax (402) 472-1901, e-mail: unldde@unl.edu; Web site: http://www.unl.edu/cwis.html

Texas Tech Guided Study

The Texas Tech University High School offers a complete diploma curriculum accredited by the State Board of Education. Undergraduate courses are also offered in six colleges of this major research university.

Guided Study, Texas Tech University, Box 42191, Lubbock, TX 79409-2191; (800) MY-COURS or (806) 742-2352, fax (806) 742-2318.

Stanford's EPGY courses are currently being offered through IAAY's Distance Learning Project and through CTD's LetterLinks. This student recounts his experience with the computer-based program.

One Student's View of EPGY

by Henry Hsieh

One problem with high school math and science classes is that they are forced into rigid schedules. And even in schools with advanced classes, there are always students who do not feel adequately challenged by the curriculum.

The Education Program for Gifted Youth (EPGY), based at Stanford, is one way for advanced students to take courses not available to them at school. EPGY courses are run at home on a computer (PC compatible) with a CD-ROM drive, through Microsoft Windows. Typically, a course is divided into short lectures of about fifteen minutes each, with a professor's voice and an on-screen simulated blackboard. Unlike classroom lectures, these can be paused and replayed. After each lecture, the program asks you questions about the material, evaluates your responses, and explains the correct answers. You get almost instant feedback because your homework, quizzes, and tests are graded electronically, by the program itself or by EPGY staff through e-mail. The physics courses include at-home lab activities that are similar to actual labs in school.

Although there is no face-to-face interaction, students can use e-mail to communicate with EPGY tutors and programmers and can also receive immediate tutorial assistance by phone.

For me, the greatest benefit of EPGY was that I could take AP courses in Calculus BC and Physics C early. This freed up my schedule, allowing me to take more electives. Another advantage was that the courses were self-paced, so I could do more work on the days when my other homework was lighter. EPGY tuition is less than that for most university courses, and EPGY provides Stanford transcripts for college applications.

One disadvantage is that many school administrations, particularly in public schools, do not give credit for off-campus coursework. So I had to take Geometry and Precalculus at my high school to satisfy graduation requirements, even though I had already received a 5 on the AP Calculus BC test. It is possible to get carried away by the self-paced nature of EPGY—a lot of my friends slacked off early on and ended up having to cram before the AP test. EPGY now closely tracks student progress to prevent this from happening; just keep up with the schedule, and you should be fine.

This method of education may become the mainstream sometime in the future. I urge all students interested in math and science to take advantage of it. ■

Henry Hsieh enjoys participating in math, science, and trivia contests. He is a senior at Gunn High School in Palo Alto, California.

IAAY (CTY)

Expository Writing Tutorial/ Young Students Writing Tutorial

Grades 8-12 (EWT), grades 6-7 (YWT)

These writing tutorial programs link verbally talented students with professional writers who have teaching experience. After you qualify with SAT-V and TSWE scores, an assigned tutor assesses your needs based upon the essays you submit. Assignments—which require 3-5 hours per week—and critiques are exchanged by mail throughout the school year. You receive a detailed evaluation after the course.

EWT Level 1 focuses on the personal essay and Level 2 on analytical and critical writing. Level 3 offers three courses: poetry, fiction, or AP English Language and Composition. In YWT, younger students learn to improve their writing while composing essays, poetry, and fiction. A limited number of e-mail tutorials are available for EWT Levels 1 and 2.

Application deadline: Early September 1996

EWT/YWT, Institute for the Academic Advancement of Youth, The Johns Hopkins University, 3400 North Charles Street, Baltimore, MD 21218; (410) 516-0161, fax (410) 516-0804.

IAAY (CTY)

Distance Learning Project

Grades K-12

The Distance Learning Project (DLP) is a new partnership between IAAY and the Education Program for Gifted Youth (EPGY) at Stanford University, which enables you to participate in challenging coursework using your home computer, CD-ROM software, and e-mail.

DLP courses use computer-based multimedia to provide audio lectures combined with text and graphics. Textbooks and off-line assignments accompany on-line work. In addition, you have access to a trained instructor via e-mail and telephone.

This is not commercial software; the bells and whistles you have come to expect from commercial enrichment products are absent from the DLP software, which is constantly revised to meet students' needs and make it more user friendly. DLP options include self-paced math from primary through secondary school courses, some college-level math, physics, Logic, and AP Expository Writing.

Students who qualify for CTY academic programs by taking the PLUS or SAT are eligible for DLP courses. K-4 applicants qualify on scholastic record and recommendations.

DLP courses are offered on a quarterly schedule. Application deadlines: December 1, March 1, June 1, September 1.

Distance Learning Project, IAAY, The Johns Hopkins University, 3400 North Charles Street, Baltimore, MD 21018; (410) 516-0241; e-mail: dlpcty@jhu.edu

CTD's LetterLinks

Grades 6-12

Through LetterLinks, you may take high school honors-level courses in mathematics, social sciences, and the humanities by mail or e-mail. For the duration of each course (about nine months), you and your tutor—a high school teacher experienced in working with academically talented students—correspond on a regular basis.

Course offerings include Algebra, Calculus A, B, and C, Creative Writing, AP Economics, AP European History, Futuristics, Geography & the Modern World, AP Language & Composition, Latin, Literary Analysis, Mathematics & Computers, Non-Fiction Writing, Philosophy, Precalculus Mathematics, and Psychology. Students taking an AP course are also enrolled in the Online AP Review Session for next May's AP exams.

Eligibility is based on your scores on SAT/ACT exams taken in grades 6-8. The North Central Association of Colleges and Schools has accredited CTD as a "special function school," so you may be able to transfer high school credit; check with your guidance counselor or principal about this possibility.

LetterLinks courses begin three times a year. Next registration deadlines: February 23, 1996, to start March 4; and May 22, 1996, to start June 3.

LetterLinks also offers two computer-based learning programs: (1) WordTeacher—College or Advanced Edition—a vocabulary-building program compatible with Macintosh and DOS, developed by Optimal Learning Systems; and (2) math courses (on a quarterly system) on CD-ROM for Windows 3.1, developed by Stanford University's Education Program for Gifted Youth (EPGY).

Center for Talent Development, Northwestern University, School of Education, 617 Dartmouth Place, Evanston, IL 60208-4175; (708) 491-3782, fax (708) 467-4283.

Duke TIP's Learn On Your Own

To participate in this program, you must find a mentor in your area who has expertise in the subject you want to study and is willing to work with you throughout the course. You receive college-level texts and supplemental materials from Duke TIP and send completed homework assignments to them. The program is self-paced; if you complete one lesson per week, each course takes one academic semester.

Subject choices include Algebra I and II, English Language: Use & Origin, Functions, Introductory Latin 1A and 1B, Microeconomics, Plane Geometry, and Reflective Writing.

Registration deadline: Open enrollment

Duke University TIP also offers an educational package based on the use of the TI-81 or TI-82 Graphics Calculator as a tool for analysis and mathematical modeling in Algebra I through Precalculus coursework, as well as in science-related coursework. The complete package includes the Texas Instruments calculator, Using the TI-81 Graphics Calculator to Explore Functions by Dr. Brendan Kelly, and a year's subscription to the quarterly newsletter *Mathegraphics.*

Learn On Your Own, Duke University Talent Identification Program, P.O. Box 40077, Durham, NC 27706-0077; (919) 684-3847.

Merlyn's Pen Mentors in Writing Program

Grades 6-12

This twelve-week program is sponsored by *Merlyn's Pen: The National Magazine of Student Writing,* which selectively publishes students' fiction, essays, poems, and comments.

The non-credit Mentors in Writing Program requires no qualifying scores or academic grades and is intended to supplement, not replace, school courses. To participate, you first provide a self-evaluation of your own writing skills and define the areas in which you want to improve. You are then paired with a professional writer or editor on the Merlyn's Pen staff whose interest in fiction, poetry, or nonfiction matches your own.

After assessing your writing, your mentor sends you personalized assignments designed to strengthen specific skills, then follows up with written critiques and suggestions for revision. Upon successfully completing the semester, you receive a written evaluation from your mentor, along with a Certificate of Achievement in Writing.

The Mentors in Writing Program is offered three times a year, during summer, fall, and spring semesters.
Next registration deadline: February 15, 1996, for March-May semester.

Merlyn's Pen, P.O. Box 1058, East Greenwich, RI 02818-0964; (800) 247-2027.

USA Mathematical Talent Search

Grades 9-12

Known as a challenging math competition, the USAMTS is also an intensive (non-credit) correspondence course in mathematical problem solving. Except for the cost of mailing your submissions, this program is **free** to all participants.

The USAMTS encourages creative problem solving as an intellectual habit rather than a once-a-year activity. For each of four rounds during the year, you receive five problems by mail and have at least four weeks to create and send in your own solutions to at least two of the five problems.

A team of professional mathematicians at the Rose-Hulman Institute of Technology and the National Security Agency returns an evaluation of your work, along with copies of the best solutions. A solution that is clear, concise, and correct earns 5 points, with a possible year's total of 100 points.

Grand Prize Winners (96-100 points) or Prize Winners (76-95 points) receive books or gift subscriptions to mathematical publications, provided by the American Mathematical Society, Mathematical Association of America, and National Security Agency. Recognition as Commended Solvers goes to those whose solution to a particular problem is especially clever. Students who participate in all four rounds and accumulate at least 40 points receive a Certificate of Participation.

The USAMTS stresses perseverance and creativity as key components in the development of your problem solving talents. Although you won't earn course credit for this program, you will receive excellent training in writing elegant solutions and proofs, refining skills that will better prepare you for the AIME and USAMO exams. In fact, all six members of last year's USA team to the International Mathematical Olympiad had been USAMTS participants.

Registration deadline: May 15. Invitations and Round 1 problems are mailed in July.

Dr. George Berzsenyi, Department of Mathematics,
Box 121, Rose-Hulman Institute of Technology,
5500 Wabash Avenue, Terre Haute, IN 47803;
(812) 877-8474/8391, fax (812) 877-3198;
e-mail. berzseny@cma.rose-hulman.edu

Gelfand Outreach Program in Mathematics

Grades 8-12

Eminent mathematician Professor I.M. Gelfand, who founded the Mathematics Correspondence School in the Soviet Union over thirty years ago, established and directs the Gelfand Outreach Program in Mathematics at Rutgers University. This three-level program encourages the development of mathematical ability by using non-standard problem solving models in algebra, geometry, analytical geometry, and precalculus.

After taking a math aptitude entrance exam, you work either individually or in groups to complete monthly assignments. The solutions and explanations you submit are reviewed and commented on by faculty members and graduate students in the Department of Mathematics. You receive a certificate for the successful completion of each year/level of the program.

Registration deadline: Students may enroll at any time during the school year.

Harriet Schweitzer, Center for Mathematics, Science, and
Computer Education, SERC Building, Room 239, Busch
Campus, Rutgers University, Piscataway, NJ 08855-1179;
(908) 445-0669, fax (908) 445-3477,
e-mail: harriets@rci.rutgers.edu

Bratislava Mathematics Correspondence Seminar

Like the USAMTS, the Bratislava Mathematics Correspondence Seminar uses a competition format that encourages independent math learning. Originating from a university in Slovakia, Eastern Europe, this program is intended for high school students who like to solve IMO-level math problems. You need no significant knowledge of math beyond the secondary school syllabus to solve these problems, but do need "some original ideas."

The contest takes place in two parts, winter and summer; each part consists of three series of problems that require solution by mathematical argument. Writers of the best solutions are invited to spend a week in Slovakia. (Air transportation is not provided, but all in-country expenses including food and lodging are covered.)

The Bratislava Seminar is coordinated by a small group of university students in the Mathematics & Physics department of Comenius University and the Unity of Slovak Mathematicians & Physicists. They prefer to use e-mail, but can make other arrangements.

e-mail: pavel.petrovic@st.fmph.uniba.sk

SELECTED DISTANCE LEARNING OPTIONS . . .

FINDING GEMS ALONG THE INFORMATION HIGHWAY

One exciting aspect of the Internet is how quickly its scope is expanding. Rumor has it that over one hundred million words(!) are added every day.

If you're an Internet beginner, you'll discover that it's great fun to cruise around the world from the comfort of your desk chair. And once you become comfortable with the technology, you can use this resource to enhance your access to information, interaction, and learning. Warning: Every site has links to others; it's hard to click on just one.

On-line Courses

Many universities offering traditional correspondence courses are now leaping onto the on-line bandwagon. Two directory options:

- **Distance Education Clearinghouse** *http://www.uwex.edu/disted/programs.html*
- **National Distance Learning Center,** University of Kentucky (K-12) *http://www.occ.uky.edu/*

FYI: The University of Wisconsin-Extension, Penn State University, Indiana University, and AT&T's Center for Excellence in Distance Learning are collaborating to increase distance education options.

A recent exploration of distance learning courses turned up these interesting samples:

- **Anthropology**, Mesa Community College
- **AutoCAD workshops**, Harvard University
- **Endocrinology, genetics, and cellular biology,** Indiana State University
- **English literature, from medieval to modern,** "Voice of the Shuttle"
- **Geography,** Australian National University
- **Interdisciplinary chemistry, math, and physics,** "Electronic Textbook," University of Pennsylvania
- **Whole Frog Project**—demonstration of 3-D anatomical imagery as a curriculum tool, Laurence Berkeley Laboratory, UC-Berkeley.

Check it out: Cyber High School is a private college preparatory school, totally contained on Internet and serving students worldwide.

Surfing

There's something for everyone on the Internet! If you enjoy academic competitions, for example, you can log on to challenge yourself with sample problems from national and international events.

- The on-line **USACO Newsletter** offers problems from all rounds of the USA Computing Olympiad, as well as a link to the 1996 International Computing Olympiad in Hungary. Also at this site is the computing "Problem of the Week," with varying levels of difficulty. (Love those cows!) *http://usaco.uwp.edu/*
- **Math Competitions Archive** *http://www.math.harvard.edu/-kedlaya/competitions.html*
- **International Mathematical Olympiad** *http://www.win.tue.nl/win/ioi/imo/*
- **Internet Center for Mathematics Programs** *http://www.mathpro.com/math/mathCenter.html*

At Yale's Web site, you click on the books on the image map to access information about the university.

Applying to College?

Take the virtual college tour: Ever aware of marketing possibilities, savvy colleges and universities are fast developing home pages that rival their own viewbooks for conveying a "sense of place" along with specific information about their departments, curriculum, faculty, and students. Let your mouse do the driving.

- **U.S. campuses only** *http://www.clas.ufl.edu/CLAS/american-universities.html*
- **U.S. and foreign campuses** *http://www.mit.edu:8001/people/cdemello/univ.html*

"The College Guide" provides interactive forms that allow you to search for colleges based on your preferences as to region, cost, class size, and type of surrounding community. *http://www.jayi.com/sbi/ACG/CGTOC.html*

Free Scholarship Searches

- **fastWEB Financial Aid Search**—database of over 180,000 privately-funded scholarships, fellowships, grants, and loans, courtesy of Student Services, Inc. You fill out a questionnaire and receive information in your "mailbox" geared specifically to your scholarship needs. *http://web.studentservices.com/fastweb/*
- **Financial Aid Search Form**—database maintained by Mark Kantrowitz, co-author of the *Prentice Hall Guide to Scholarships and Fellowships for Math and Science Students.* *http://www.purdue.edu/DFA/scholar.html*

THE PEDAGOGICAL PROMISE OF COMPUTER-BASED EDUCATION

by Raymond Ravaglia

How Well Can Computers Teach?

"Is computer-based teaching better or worse than human instruction?" "Will computers ultimately replace real live teachers?"

Questions such as these are ultimately misguided because they presuppose a false dichotomy. In fact, much of today's best computerized instruction includes a built-in human element. The ideal question is not a choice of either/or, but how technology and teachers can collaborate for everyone's benefit.

This article will not repeat standard claims about the convenience or accessibility of computer-based learning. Rather, it will describe how computer-based instruction can enhance precollegiate and collegiate education (1) by providing sensitive assessment of each student's learning needs, and (2) by adapting the rate and content of the curriculum to match those needs.

Redefining the Instructor's Role

In colleges and universities, the traditional unit of instruction is the lecture. The impetus behind the lecturing convention is not pedagogic, but economic: one person talking loudly can address more people. Educational technology has reenforced this approach. The microphone allows more students to hear. The overhead projector allows more students to see. The televised classroom allows more students to be reached without requiring that they all fit into one large room.

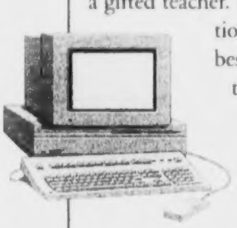
No one would call any of these advances pedagogically significant. In fact, when a teacher addresses a class instead of an individual, what is gained in economy of scale is offset by the lack of personalization of the curriculum.

However, computer-assisted learning technology is now in a position to redefine the role of the human teacher. Computers can maximize instructors' effectiveness by providing them with critical information about their students and by greatly expanding their available teaching tools.

Customizing Instruction to Individual Needs

It would be great if all human teachers could address students individually, find out about each one's preparedness and learning style, and proceed appropriately case by case. But in most of today's overfilled classrooms, this just isn't possible. Here's one place where computerized instruction can make a real contribution.

At the heart of the benefits of computerized learning is technology's enormous capacity for collecting vast amounts of detail and processing those bits into meaningful results—tasks too time consuming for human teachers.



Computers can be programmed to assess students' levels of mastery by noting the time it takes an individual to solve a problem, the steps taken to obtain the response, and whether or not the solution is correct. An assessment algorithm can then evaluate this information to discover soft spots in a student's understanding. If the student tends to do poorly on problems involving spatial tasks, for example, the algorithm can detect this and select appropriate subsequent tutorials and problems.

The computer has thus provided the instructor with data that would otherwise have required observing each student work numerous problems. The instructor can now use this information to design an educational program appropriately tailored to that particular student.

Customizing Instruction to Individual Interests

The other great advantage of computerized instruction is that it can provide an amazing repertoire of supporting material, allowing for a curriculum that is custom-tailored to the student's interests or learning style.

For example, some students learn better when they can see the practical applications of a theory or idea, others when they know the story behind its development.

To respond to the individual, computerized instruction can make material available at different levels of abstraction. It can incorporate supplementary material, such as lectures, to present relevant side topics. It can preserve different voices and perspectives. And if the program is interactive, it can adapt the learning level and pace to the student's responses.

Can computerized instruction work across the board in all subjects? It's easy to see how individualized instruction can strengthen a course in calculus or chemistry. But what about one in the humanities? Literature, for example:

> *"O for a Muse of fire, that would ascend*
> *The brightest heaven of invention . . . "*

This vivid opening line from Shakespeare's *Henry V* may receive an inspired reading from a gifted teacher. But computer-based instruction could add a lot to even the best "live" teaching session on this play. Students could listen to a variety of readings of and perspectives on the work from several actors and scholars. Other hypertext options might describe the real Henry V's life story and historical setting, or explore the other contexts in which Shakespeare used the word "muse." Interactive recorded lectures could pitch discussions of the text to fit the needs of different students.

Conclusion

Computer-based education, by virtue of its ability to provide each student with instruction appropriate to his or her level of mastery, style of learning, and personal interests clearly has certain benefits over human-taught classes. Such technology provides a great resource, not a threat, to teachers and teaching.

In the computer-assisted classroom, the teacher—freed from the need to address the entire classroom at once—can interact with students one-on-one or in small groups. In such a classroom, teachers have a truly rich opportunity to *teach.* ■

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PERSPECTIVES

DR. HEINRICH STUMPF AND HIS SPATIAL TEST

by Lesley Mackay

Researchers are currently working on refining tests of spatial abilities. Their interest is due, in part, to these tests' proven power to predict: links have been demonstrated between spatial skills and achievement in mathematics and science courses.

Mind Benders

- *A long plastic cable, twisted into several loops and contorted like Houdini, sits inside a transparent cube. Another image—alike, yet somehow different—follows. How does the second image recast the first? Does it show the same shape from the right, from the left, from above, from below, or from behind?*
- *A three-dimensional block, with various geometric shapes carved into some of its surfaces, is accompanied by five spin-off figures. Which would be identical to the original if that form was rotated clockwise 90 degrees?*

Sets of problems like these form the questions on tests of spatial ability. These tests make two basic demands: test-takers must (1) visualize adjustments of a given form—for example, picture what irregular figures would look like if they were rotated—and (2) recognize relationships among arranged objects and shapes. The tests are almost always timed, with perceptual speed an important factor in individual results.

A good performance on such a test can indicate scientific promise in, for example, one sixth grader who can't wait for biology and another who only likes reading.

Building a Better Crystal Ball

For the last four years, Dr. Heinrich Stumpf, a researcher for the Institute for the Academic Advancement of Youth at The Johns Hopkins University, has been assembling and pilot-testing a battery of such spatial tests. These days he is immersed in the final stage of production—drawing pictures that require mental plotting through space.

Poised over his computer, with long, fine hands extended like a pianist's, Stumpf seems to be playing a curiously gentle video game. On a grid hovering in front of him, he marks out a constellation of connected points. As he shades in the third dimension, the constellation becomes a trapezoid. When he presses a key on his keyboard, the figure on the screen jumps, rotates, and settles. Stumpf quickly saves both pictures.

"For this particular problem, I use a model to generate a second drawing, my true solution, which is the same figure rotated clockwise 180 degrees. Then I draw another model, a figure with a slightly different construction. From this second figure, I generate four rotations that are false solutions. The question is, which figure shows the model rotated clockwise 180 degrees?"

"It's a complex question," he says, "which requires test-takers to notice that some solutions are based on a shape that is a bit different from the model."

Identifying Spatial Skills

In their exploration of spatial abilities, psychologists have identified sixteen classes of spatial tasks. These include working with mazes, pattern assembly, gestalt resolution, copying tasks, and virtual paper folding. For three years, Stumpf reviewed data on each type of spatial task, looking for those with the strongest ties to achievement in science and math.

"Some tests belonged to other scholars. Some I generated myself, comparing students' performance on my tests with their later progress in particular academic programs."

There were other considerations, too: "I am testing children. As much as possible, I want to test for spatial ability, not test-taking stamina. The dilemma is that the longer the test, the more reliable it is; but on a test that is too long and demanding, results will become strongly correlated with endurance."

For his test for students in seventh grade and above, Stumpf ended up choosing four spatial tasks: cube perspectives (looped and contorted cables), block rotation (pivoting forms), surface development (folded and unfolded boxes), and visual memory. For his test for the youngest students, he eliminated the cube perspectives.

"My test is difficult, but it is supposed to be; it has a high ceiling. On average, test-takers get roughly half our items correct. This is ideal."

High-ceiling tests work at the outer edge of test-takers' competence. Their purpose is to take talented or well-prepared test-takers over the edge of what they are likely to know. In so doing, such tests sort out students with good ability from those with amazing talent.

Gaining from Computer Technology

As Stumpf pulls together his spatial battery, changes on the testing horizon are about to transform the protocol of the tests: "The experimental versions we have administered so far have been paper-and-pencil multiple choice tests." (Test-takers are hardly ever required to draw.) "But the test will very soon be administered at the computer, and later it will be made adaptive."

Adaptive tests respond to students' correct and incorrect answers. The computer program chooses questions at the last second, based on whether or not the previous item was answered correctly. This process leads to more precision in measurement with less time required for testing.

Computer testing will bring other benefits, too. "Computer administration will allow us to show the rotation of blocks, providing much better example-problems to students," adds Stumpf. "And test-takers will get an immediate score."

Evaluating Gender Differences

Spatial testing is not without controversy. Some have questioned its merits due to the significant gender division in scores. One 1979 survey reported male superiority on spatial tasks as "among the most persistent of individual differences in all the abilities literature." Gender differences in performance did vary, but according to specific spatial tasks. For example, males did much better mentally rotating platforms of blocks with additions extending in different directions, while females showed stronger visual memory.

In the more than fifteen years since that survey was conducted, the gender gap on spatial skills appears to have narrowed—raising interesting questions about the interplay of ability, environment, and training. Perhaps changes in socialization or education have fostered females' capacity to think about space.

Exploring Potential

Stumpf's work on his test battery is timely. Spatial tests have been around for years, but have not been as widely administered as are tests of verbal or mathematical reasoning. Today, some educators are intrigued by their potential. What if spatial tests were added to the regular program of standardized assessment? Could they flag abilities that currently go undetected? Identify promise in students who now pass more or less unnoticed? That, at least, is the hope. ■

Born in Cologne, Germany, **Heinrich Stumpf** studied philosophy and psychology at the University of Bonn. Within psychology, he specialized in individual differences and test construction, and was primarily responsible for the German adaptation of the "Personality Research Form" that is widely used in North America.

After receiving his doctorate, Dr. Stumpf joined a team of psychometricians who were creating the "Test for Medical Studies (TMS)," now taken by aspiring applicants to German medical schools. While working on some of the TMS subtests, he also developed both the psychometric evaluation of the TMS and software to perform statistical analyses. Among the tests he helped to construct was a measure of spatial ability, the Cube Perspectives Tests, later published in several versions and now widely used in Germany.

When Dr. Stumpf joined the Center for Talented Youth in 1991, he began studying scientific innovation and how to identify young students with scientific talent. This work led him to the development of a CTY Spatial Test Battery (STB), presently being adapted for computer administration. Dr. Stumpf also studies cognitive gender-related differences and writes review articles, including textbook chapters on classical test theory and computerized testing. ■

SPATIAL ABILITY TEST

The following samples illustrate three categories of spatial ability tests currently being used. Remember that the level of difficulty of these tests is enhanced by time limits. (Answers appear below.)

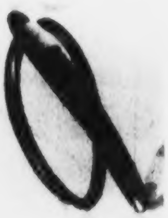
Test 1: Cube Perspectives

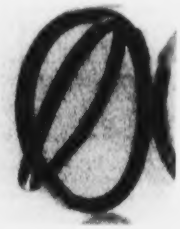
This is a test of your ability to imagine how objects look from different viewpoints.

Each problem in this test consists of a pair of pictures showing a transparent cube with a twisted cable in it. The left-hand (first) picture always shows the front view of the cube; the right-hand (second) picture shows the cube from a different view.

Your task is to find out from what view the cube is seen in the right-hand picture: (A) from the right, (B) from the left, (C) from above, (D) from below, or (E) from behind.

The full version of this test has 21 problems to be solved in 12 minutes.





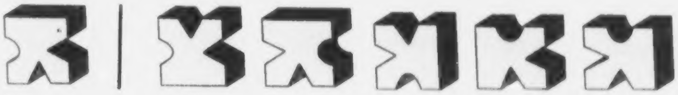
Test 2: Block Rotation

This test measures your ability to imagine what blocks look like after they have been rotated.

You will see drawings of blocks of different shapes. The block on the left of each row is the model block. The five blocks on the right are answer choices. Which is/are the same as the model block?

In this test, the blocks are rotated only clockwise or counter-clockwise, not towards or away from the viewer. So everything that is in the background stays in the background, and everything that is in the foreground stays in the foreground.

The full version of this test has 15 problems to be solved in 12 minutes.

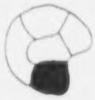


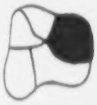
Test 3: Visual Memory

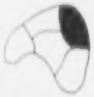
This test measures your ability to remember figures.

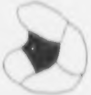
On the full version of the test, you are given 20 figures. A part of each figure is blackened. You are given 5 minutes to memorize all 20 figures and their blackened portions.

Sample of some figures to be memorized:



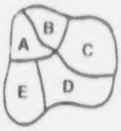






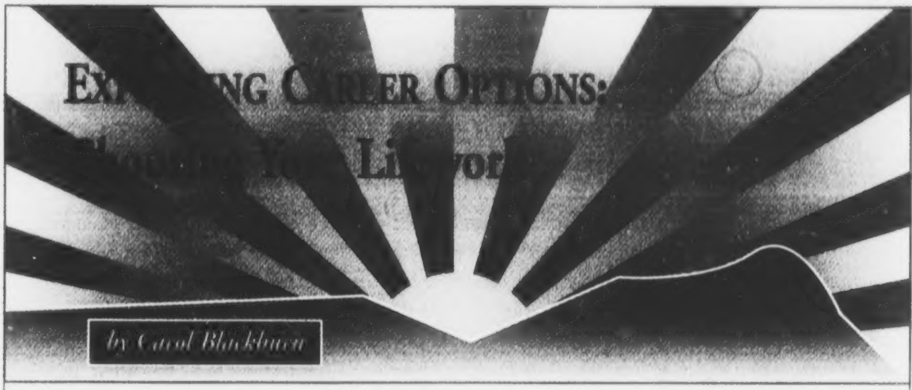
Thirty minutes later, you are asked to identify the blackened parts of the 20 figures. The figures on the answer sheet are neither rotated nor turned over, but appear in a different order from those you memorize.

Sample of one item: Identify which part was blackened.



Descriptions adapted for this article from tests copyrighted by Verlag für Psychologie, Dr. C. J. Hogrefe (© 1986).

Answers: Test 1 (C); Test 2 (E); Test 3 (C)



EXPLORING CAREER OPTIONS: Choosing Your Lifework

by Carol Blackburn

"WHAT DO YOU WANT TO BE WHEN YOU GROW UP?" (Don't you get tired of hearing people ask you that?)

For some of you, the answer is easy. But for many, especially given the ever-expanding universe of professional possibilities, it's not a trivial question.

In this issue of *Imagine*, we begin a new series that will offer glimpses into the lives of individuals in a wide range of professional arenas. We hope the interviews in this series will provide you with two kinds of information: (1) a picture of one life in a particular career field, and (2) an inside look at how some individuals have selected or created rewarding professional lives that are well suited to them.

In all cases, our interviewees' abilities have been strong factors in determining their professional choices and successes. However, other important factors—their interests, personalities, values, life experiences, and the historical time in which they came of age—have also contributed to their career paths.

This introductory article highlights some of the questions and issues that will recur throughout these interviews and points out some factors to contemplate as you consider different careers. We also include comments from students now in their mid-20s about the experiences and factors that have been most important in shaping their career decisions.

A Good Match

As you search for a career that will suit you well, consider two major criteria: (1) how well the work satisfies your abilities, interests, goals, and values; and (2) how well what you have to offer satisfies the requirements of the work.

That sounds straightforward enough. If only it were that simple! One young engineer described his struggles with the first issue in this way: "I haven't quite perfected my decision-making algorithm; I'm still trying to determine the relative values for all the coefficients in the equation." While not all of us would describe our decision-making in quite such mathematical terms, his comment captures a truth: choosing a career does involve many factors and considerations, and only you can decide how much weight to give to each of them. No one else can write your personal decision-making algorithm for you.

The second issue—how well you would fulfill the requirements of the work—can be less of an issue for academically talented individuals, many of whom are sufficiently able in a variety of areas to be successful in many careers. However, even highly able students have relative strengths. And any given career draws not only upon specific abilities but also upon particular personality characteristics.

As you look into various careers, examine the constellation of features that characterize people who are successful in and satisfied with the field. Then, consider how well you fit that description. You're more likely to be successful—and happy—in a career that will utilize and value a wide spectrum of what you have to offer.

The Big Picture and the Daily Life

People are often attracted to a particular kind of work because of the appealing *big picture* they associate with that field: discovering the secrets of the universe's beginnings, publishing a great novel, making a more just society, finding a cure for cancer or AIDS. The prospect of the satisfaction one would feel in moments of great discovery or accomplishment can be quite compelling.

However, very few careers consist of a sustained series of "Aha!" experiences, and no career is lived only at the big picture level. Most work entails a lot more time spent on the plateaus than at the peaks. As you investigate different careers, it's extremely important to find out about the *daily life*. How do people in this field spend their time, both in the early days and in the more mature stages of their career? What do they find rewarding about their work?

Explore. Talk to as many people as you can. Get some personal experience. Here's where internships or shadowing (following someone around for a day or so) can be invaluable, giving you a first-hand look at "a day in the life," allowing you to reality-test your impressions of various fields.

Individual reactions to the same kind of work can be vastly different, as exemplified by the following comments from two students who were both considering careers in medical research. One discovered, "Nothing is more exciting than planning an experiment, conducting it, and getting a result, whether expected or not." The other concluded, "A year of research experience quickly showed me that I wasn't cut out for a career in the laboratory. The work was—for me—frustrating, confusing, tedious, and difficult."

While some may be turned off by an internship experience because they happen to participate in a project during a discouraging phase, a negative experience may accurately reflect a bad fit between your interests or personality and the life offered by a career. No matter how engaging you find the subject matter, if you don't also enjoy the day-to-day life, you won't be as happy as you would be in a field where you appreciate both the big picture *and* the daily life.

Personal Satisfactions and Rewards

People vary tremendously in the personal values, goals, and needs that they want their work to satisfy. The list of such considerations is long and might include intellectual challenge, competitive excitement, creative self-expression, humanitarian concerns, leadership opportunities, spiritual values, financial security, the respect of one's colleagues or of the community at large, and the freedom to set one's own agenda.

For academically able individuals, a desire for intellectual challenge is often among the most important considerations in choosing a career. Some, however, discover that this is not the paramount factor in their job satisfaction. For example, one mathematically talented individual decided to place a higher priority on satisfying other aspects of himself:

"Working in public policy has moved me away from people with whom I might feel most intellectually compatible. I am not surrounded by mathematicians, nor even by analytically-oriented people. I probably am not as intellectually challenged as I might have been had I stayed in academia. But I feel that I am using my skills to do something worthwhile—to promote sound public policies and to play a direct role in improving the society around me. It is less ***intellectually*** *rewarding than I imagine some academic pursuits might have been, but I think more* ***personally*** *rewarding—and challenging. I have to learn to combine my intellectual abilities with social skills to convince people to make changes in public policies. Compared with changing someone's mind, proving a theorem is a piece of cake."*

Many aspects of yourself may ideally find expression in your choice of a career, and the process of defining those that are most important to you is a highly individual one. But the benefits of such self-examination are great.

Life-long Learning and Personal Growth

In our dynamic and rapidly changing world, continued professional success is inextricably linked to life-long learning. Given the exciting (and unavoidable) fact that, whatever you choose, your professional life will entail continued learning and development, it's worth thinking about the kinds of long-term personal growth you would like your professional life to foster.

Think big. Try, as much as possible, to leave the door open to possibilities you might want to pursue. Consider the breadth of opportunity that a particular training or work experience might afford you later on. As one graduate student in economics explains:

"Economics allows me much more flexibility in working on topics that are close to my other interests. If I develop more policy interests in the future, my training and career path will be able to accommodate them. In contrast, my interests in math and computer science have been a much smaller proportion of 'all the things in life that interest me.' I think that is probably the key distinction—that economics seems much more widely applicable for someone like me who tends to have a balance of technical interests along with a good dose of curiosity regarding social and public policy issues."

In reading the comments of our interviewees—and in talking with others about their careers—notice which aspects of themselves their work has encouraged, required, and sometimes even forced them to cultivate. And try to think ahead to your own evolution.

Historical Context

"Certainly those determining acts of her life were not ideally beautiful. They were the mixed result of a young and noble impulse struggling amidst the conditions of an imperfect social state. . . . For there is no creature whose inward being is so strong that it is not greatly determined by what lies outside it."

—George Eliot, *Middlemarch*

We all come of age and make life decisions at a particular time and place in history, within a particular culture and subculture. One of the biggest challenges in making life choices is finding a good balance between personal interests and the avenues available for pursuing those interests. While your "dream life" might have been to be a physicist in the early 1900s, you may find that being a physicist in the early 2000s is not as compelling an option as a variety of other careers—many of which did not even exist in the early 1900s.

For all of our interview subjects, the particulars of time and place played a large role in the opportunities that were available to them. In addition, however, they were skillful in recognizing opportunities that were promising and well suited to their own interests and abilities, and they were flexible and adaptable in taking advantage of them.

Conclusion

As you read the comments in this article and in future interviews that will appear in "Exploring Career Options," notice which career factors seem to resonate the most with your own abilities, interests, goals, and personality. The better you know yourself, and the more your self-understanding informs your career decision-making, the more you can create a life that will cultivate those aspects of yourself you value most—and the more satisfied you will be. ■

PUTTING THESE SUGGESTIONS TO WORK IN YOUR OWN LIFE

Learn about Yourself . . .

A recurrent theme throughout the interviews in this series is that we often take our own abilities and personal strengths so much for granted that we are not sufficiently aware of how unusual or valuable they are. Most of us can benefit from getting feedback.

■ ***Abilities:*** Standardized tests can provide a measure of your abilities relative to those of others and can identify some of your greatest strengths. Of course, not all abilities can be assessed by standardized tests; people who know you and your work through curricular and extracurricular experiences can evaluate many of your other skills and abilities. Several of our interviewees commented on the importance of feedback from their teachers or mentors in helping them identify—and work on—their own strengths and weaknesses.

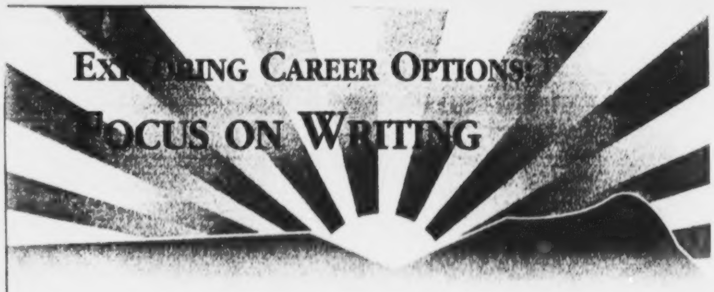
■ ***Personality and Interest Assessments:*** While such tests are inevitably a bit simplistic, they can give you an objective assessment of, for example, the strength of your preference for analytical thinking or for seeking harmony and consensus among the people around you. The Myers-Briggs Type Indicator and the Strong-Campbell Interest Inventory are two assessment tools that many career counselors use.

Learn about the World of Work . . .

■ ***From Professionals in the Field:*** Take advantage of all the resources available to you—talk with teachers, mentors, your parents, their friends, even complete strangers working in fields that interest you. Read biographies and interviews. Dig!

■ ***Through Work, Internships, and Shadowing:*** These experiences give you a window on the world you are considering, allowing you to reality-test your ideas about life in a given career.

Remember, too, that each work experience is an opportunity to learn not only about a career but also about yourself. In each setting in which you find yourself, be both a participant and a detective—enjoy your work and assess which aspects of it are most satisfying to you.



EXPLORING CAREER OPTIONS: FOCUS ON WRITING

by Lesley Mackay

Do you want to write? What kind of question is that?! You're already very prolific: Essays about trips you have taken. History homework. Letters to your grandmother. And that twelve-page fantasy about the 23rd century, when computer-literate flamingos wreak havoc on the Earth.

Of course, some people write more than others, and with a deeper sense of commitment. How do you know whether you and the written word are just friends or truly meant for each other? Real seriousness has set in if you find yourself staring at sentences—your own and other people's—and noting: "That's a nifty turn of phrase." "No, fireflies glow like torchlight, not stars." "I don't like his description of the appendectomy. Not enough detail."

Although a life crafting pieces of writing is a life crafting sentences, there's a big picture, too. Great adventure awaits. Just ask Rob Kanigel and Lesley Rogers, interviewed in this issue. They both describe the fun they have exploring new worlds to be transported to the written page.

Both Rogers and Kanigel recognize that—unlike preparing for a career in medicine, with its highly structured, mandatory apprenticeship—there is no one way to pursue a career as a writer. Many highly individualized paths can lead to that destination. This can be liberating, but also troubling. What can serve as your compass? How do you know where you are? There may be times when the only person who thinks you are a writer is . . . you. But a remedy exists for all this uncertainty.

Write! If you write, you are a writer. Do you keep a journal? If not, start one today. Write for yourself, as well as for your teachers and other readers. Flesh out brilliant ideas and mundane ones. Record the best day in your life, and describe an unbearable afternoon. Paint word portraits of your cat, your lab instructor, and your best friend. Sketch a day in the life of a student like you—in your favorite place and most intriguing historical moment. Do some research, and work on detail.

Through extensive practice, you are developing the most critical quality in writing: fluency. First, you'll work on facilitating the flow of your words onto the page. Then, you'll work on polishing those words. Remember that it takes hard work to create writing that appears effortless.

As you face the task of nurturing your writing, you are far from alone. Help is available to you, and from many sources. Some of you may already have mentors who are willing to help you develop: teachers, a relative, someone in your community whose attention you have earned.

If you don't have a mentor yet, keep your eyes open for someone willing and able to extend a hand your way. One beautiful aspect of literary history is the tradition of writers' assisting each other despite their own demanding lives. Teaching, active collaboration, friendly advice, and the works of a respected predecessor can all add energy and refinement to your sense of purpose.

The resources nearest at hand—and perhaps the most important of all—are models of the kind of writing that interests you. All you need is a library card to open the door to the amazing traditions on which your work will stand.

While it is important to work hard, read, and learn from more experienced authors, it is also important not to be frantic. In the great *Letters to a Young Poet,* the German lyric poet Rainer Maria Rilke (then 27) wrote to an even younger writer about his philosophy of artistic development:

> *In this there is no measuring with time, a year doesn't matter, and ten years are nothing. Being an artist means: not numbering and counting, but ripening like a tree, which doesn't force its sap, and stands confidently in the storms of spring, not afraid that afterward summer may not come. It does come. But it comes only to those who are patient, who are there as if eternity lay before them, so unconcernedly silent and vast. I learn it every day of my life . . . patience is everything.*

Patience is important not only for its own sake, but also because it will allow time for you to unfold as an individual. This is essential for gaining your own voice as a writer; the growth of your powers of expression is intimately involved with your growth as a person.

Being patient doesn't mean being lazy. Sometimes the best thing you can do for your writing is to gain more knowledge and experience. Take that trip to the Texas border. Commit your Saturday mornings to a shelter for the homeless. Sit in the library and delve into ancient history. Then go home and experiment in words with what you have learned. Listen again to Rilke:

> *You are so young, so much before all beginning, and I would like to beg you . . . as well as I can, to have patience with everything unresolved in your heart and to try to love the questions themselves as if they were locked rooms or books written in a very foreign language.*

Keep your goal in mind, of course. But don't forget to value the journey. ■

Selected Resources

- *The Writing Life,* by Annie Dillard
- *Writing Down the Bones: Freeing the Writer Within,* by Natalie Goldberg

- *Elements of Style,* Strunk & White
- *Line by Line: How to Improve Your Own Writing,* by Claire Kehrwald Cook

Watch for the focus topic of *Imagine*'s May/June 1996 issue: "Pursuing Writing Opportunities."

AREER OPTIONS: FOCUS ON WRITING

by Lesley Mackay

Interview with Lesley Rogers: Senior Assistant Editor, Director of Research, and Chief Stylist at *National Geographic Magazine.*

*As Director of Research, **Lesley Rogers** supervises staff who verify each statement in the magazine. As Chief Stylist, she examines every story for grammar, punctuation, and style.*

You've worked at the** National Geo-graphic Magazine **for thirty years and are one of its top editors. Tell us about your rise within the organization.

I held a degree in History with a minor in English from the University of Maryland and started at *NGM* when I was a few months out of college. I was placed in the geographic section of the research department, which incorporated the scientific, the geologic, and the technical—all fields in which I had little background.

I quickly grew to like my work. After a couple of years, I was assigned complex articles on space and space exploration. I impressed enough people that I got equally challenging research assignments after that.

What exactly did you do as a researcher?

I followed the writer's trail, verifying his or her claims, and checking quotes and references. At *NGM*, researchers also arrange for articles to be reviewed by outside readers. The purpose of the reviewing is to ensure that our articles offer a balanced perspective on the topics they address.

How long did it take before your first promotion?

After about five years, I began to edit as well as research. Our editors coordinate the work of writers, researchers, reviewers, and stylists. About twelve years later, I became Associate Director of the Research Division, and four years after that, I was named Director of Research and Senior Assistant Editor.

You must have been happy at** NGM **to stay so long.

It's a stimulating and comfortable place to work—perhaps, for some, too comfortable. Young people who take administrative or research positions in the hope of becoming staff writers can get very frustrated if this doesn't happen. I think in many cases they would do well to move on to a place where they can focus on developing their writing.

Lesley Rogers, with her husband, Elie Rogers, who is Picture Editor at NGM

Has the magazine's diverse subject matter helped maintain your interest over the years?

Yes. If you don't care much for one particular subject, you work on it for six or eight weeks and then move on. I came with a very general background in science and technology, but developed strong interest in those fields. At one point, I was educating myself about particle physics.

Have you happened upon a particular subject that you have become a bit fanatical about and really pursued in your work?

Yes, the space field. The first article I worked on about the moon, written before the Apollo VIII launch, was a wrap-up of what we knew about the moon pre-launch and about what we hoped the launch would teach us. That was a real crash course.

I went to the Apollo VIII launch in Florida in December 1968, and I researched our ensuing article. I ended up attending several Apollo launches and keeping track of each mission as it proceeded. And I worked on related articles—on the universe, stars, black holes, quasars, planets, the Voyager missions. The more I learned, the more fascinating space became.

I have been fortunate in my career. I have been given challenging assignments that led me to greater things. But the other side of that coin is that when I was given an assignment I always tried to stretch my capacities as much as I could.

Do you have any regrets about "what might have been" if you had made different decisions along your career path?

I'm a person who tends not to second-guess my commitments, and I can't say I've had many regrets. However, I do sometimes think it would have been interesting to pursue an advanced degree in some of the fields I have explored at the magazine.

My background is that of a generalist, not a specialist, and that has added to what I have been able to contribute to the publication. It is easy for me to identify with the general reader. But I think it would have been nice to have been a specialist as well.

Let's talk about writing and editing now. Do you have strong feelings about the importance of substance and style in written communication?

Yes, and I think students are getting inadequate educations in writing. I hire many people who have been out of college for a couple of years. While they are often quite self-confident, I'm sometimes appalled by how they write—without organization, concision, or clarity. Writing is so important, regardless of your field. I think young people should write as much as they can, much more than schools currently require of them.

What advice do you have for young writers?

My advice would be that, no matter how highly your student writing was praised, you must work hard at writing after school and college. A person who wants to write must simply write and write, starting with smaller publications and getting as much experience as he or she can.

Talent is important, but even the most talented can't take the process of writing for granted. You have to do a great deal of revision. It's not a natural process: it's hard work. And you may not get your dream opportunity right away. But I think that if you're good and you're willing to work, the opportunities will come. ■

EXPLORING CAREER OPTIONS: FOCUS ON WRITING

by Lesley Mackay

Interview with Robert Kanigel: Freelance Writer

*Robert Kanigel is the author of two acclaimed books—**The Man Who Knew Infinity: A Life of the Genius Ramanujan** (in paperback, Washington Square Press, 1991) and **Apprentice to Genius: The Making of a Scientific Dynasty** (in paperback, The Johns Hopkins University Press, 1993)—as well as hundreds of magazine and newspaper articles. He has just completed **The One Best Way**, a biography of Frederick Winslow Taylor, the first industrial efficiency expert, which is scheduled to be published by Viking in 1996.*

You have achieved extraordinary success as a freelance writer. What was it like building up your career?

Well, you have to separate out the earlier days. In the beginning, I would wake up grateful to be supporting myself by writing. It seemed like the best thing in the world, and it still does.

I benefitted from growing up in the '60s. Although I worked hard, I didn't feel pressured by a notion of career. But there were low points—when I had articles rejected, for example. Then, when I wrote my first book—which was about city living—and nothing came of it, I was devastated.

How did you bounce back from that?

I took time off and changed cities. I wrote query letters, met editors, and did all the usual stuff. There was one point early in 1976 when I had no work at all. It was really depressing, but that was the last time.

Now, part of my freelance strategy has been to cultivate more work than I need. I try to get as much lead-time as I can from an editor so I can juggle multiple tasks as effectively as possible.

These days, a lot of people go to school to learn to write. Since you hold a B.S. from Rensselaer Polytechnic Institute, I guess you didn't do that.

At the beginning, I was purely self-taught. My mother suggested that I get hold of Strunk and White's *Elements of Style*. Everyone should read it at least once a year. It's not an exaggeration to say that the first time I read Strunk and White, it was a revelation to me. The whole spirit of the book, its emphasis on economy and directness, provides an excellent perspective. I was as laden as anyone else with the idea that I was supposed to sound like a big shot when I wrote. Strunk and White spoke to that mistake.

Robert Kanigel

It must have been challenging, creating your own network of contacts such as editors.

I have been working as a writer for twenty-five years. You build up your network very gradually. In the beginning, you bootstrap yourself up from one or two small publications to others.

I have never been on the staff of a newspaper or magazine, but I have had steady relationships with publications. For example, I was a contributing editor of *Johns Hopkins Magazine* for a number of years. That, in a lot of ways, represented my coming of age. There was an editor there, Elise Hancock, who taught me everything.

I find that when any new person sees my writing, the feedback I get is what allows me to grow.

I agree and would go so far as to say that you don't learn except through what might appear to be failure. It's when an editor says you've messed something up that you learn. You learn by doing it again and again, confronting a writer's problems millions and millions of times.

Have there been important moments in the development of your career—important revelations, meetings, real turning points?

I would like to write an article about the signposts that appeared along the way. One that comes to mind is an article I wrote for *Johns Hopkins Magazine* in 1977. It was called "Architectural Genesis: One Building and How It Came to Be." The focus was on the human decisions that led to the building's becoming what it eventually became, in all its particularity.

In the course of my writing that article, the idea of storytelling, of starting out with "In the beginning . . . ," came to life for me. I realized that a complex subject—architecture—could be made accessible through narrative. I've been telling stories ever since.

I'd like to talk about your interest in science. It must have been challenging to write about very advanced mathematics for a lay audience in your biography of the Indian mathematician Ramanujan.

It was hard. I'm interested in a lot of things—almost pathologically. Some people call me a science writer, but I don't consider myself that. I consider myself a writer with a lot of interests, including science and technology.

My attitude is that if I am interested in something, I don't let the complexity of it get in the way. A writer who comes into a field with a particular curiosity can never be a scholar with years of expertise in that area. But in order to do the subject justice, the writer must and can face the complexities of the discipline.

If you are not a science writer, is there any rhyme or reason to the subjects that attract you?

I tend not to be interested in things that are lacking in intellectual content. Intellectual substance allows me to do what I like to do in writing—to raise the stakes. I don't content myself with one level of a subject; I try to raise the stakes of my piece with new contexts and subtexts.

You have written two biographies, and your book on mentorships in science also has a biographical flavor. Is there something about the biographical form that appeals to you?

I don't see myself as an adherent of any particular form. I don't much believe in forms. Take book reviews, for example. There is really no such thing. Essentially, a book review is no different from a biography. Both of them face the writer with a problem: any time you write, you must put your arm around your readers and bring them into your world. Whatever someone else labels your piece of writing doesn't matter.

What is your typical working day like?

It depends on whether I'm writing or researching. When I'm writing, I often work a twelve-hour day with a long lunch break. I have to approach writing like a job; otherwise, it doesn't get done. When I'm researching, the events of my day depend upon what kind of research I'm doing, whether I'm working at the Eisenhower Library, for example, or traveling. While researching the Taylor book, I took a six-week trip around Central Europe to recreate the Grand Tour that Taylor had taken with his parents in 1869 when he was 13 or 14—which he richly described in his personal journal. I returned with clearer insights into his personality, and an incredibly useful two hundred pages of notes.

Do you ever struggle with writer's block or some other kind of resistance to writing?

That's two separate questions. Writer's block, no, never. Resistance to writing, yes. But I have learned to take the resistance and use it. I ask myself: Why am I fighting this project? Why don't I want to do this? Usually, my resistance indicates something faulty in my approach. I have most likely set up the writing task in a way that is mechanistic or boring. I need to come up with a structure that is better for me.

How has your writing grown over the years?

Back to using resistance: What I've generally learned is to rely on myself, to listen to myself emotionally, without being too objective and rational. My biggest task has been to resist being orderly, logical, thorough. I know that sounds paradoxical, but it's true. Those things are in my nature, and I value them. But I've also had to learn to go with what appeals to me, even if it's an appeal I don't understand.

Over the years, I have come to view myself as having much in common with a cobbler or furniture-maker. Instead of shoes or furniture, I put together articles and books, using words and ideas as materials. In my one-man operation, I am craftsman, artist, businessman, and janitor.

What kinds of educational or personal experiences would you recommend for young people who aspire to the writer's life?

The fact is that I don't know. My real education as a writer began the moment I got out of college. There are certain qualities that are basic to your ability to learn as a writer. Not being afraid of things that are unfamiliar or difficult is part of it. Forgiving yourself for what you don't know yet is also essential.

Everything I think I know about writing comes from the experience of writing, itself. There, I think I have learned a lot. It's not so much the education that you start out with; it's your willingness to learn as you go. The whole process is educational. ■

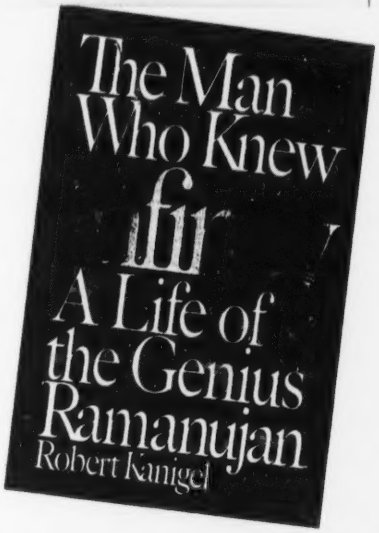
THE LONELINESS OF THE LONG-DISTANCE MATHEMATICIAN

By Susan Hellerman

A Review of

The Man Who Knew Infinity: A Life of the Genius Ramanujan

by Robert Kanigel



Have you ever had the feeling that your exceptional reasoning ability set you so far apart from your fellow middle or high school students that you had no peer group? Being different isn't easy, so talented students usually revel in the experience of summer programs or academic competitions where they can meet, study, and have fun with others who are as excited about learning as they are.

Imagine how you might feel if there were no opportunity for interaction with your intellectual peers . . . no one you could talk to about the marvelous way your mind works . . . no one in the entire country.

Such was the bitter lot of the mathematical genius Ramanujan, born at a time and in a place where none of his compatriots could appreciate or even recognize his intuitive brilliance. So ahead of his time was he that even now, seventy-five years after his death, the mounds of notebooks Ramanujan left behind are still being edited, still revealing precious secrets from the Platonic realm of pure mathematics. The tortuous, magical tale of this profoundly gifted man is told in rich detail and with compelling insight by Robert Kanigel in *The Man Who Knew Infinity: A Life of the Genius Ramanujan.*

Born in a village in southern India in 1887, Srinivas Ramanujan Iyengar grew up in that curious cultural amalgam of entrenched ancient religions and stultifying British Empire bureaucracy. His poor, Brahmin Hindu family struggled for the tuition to enroll him in schools, where teachers soon gave up on him because he neglected all his coursework to sojourn in a private world whose godly abstractions he translated obsessively onto a chalk slate.

In 1913, unable to publish his work and in deep despair, twenty-five-year-old Ramanujan began sending long letters full of his idiosyncratic formulas to well-known mathematicians in England. One after another of these experts simply dismissed him as a crank because, since Ramanujan was uneducated and never bothered with proofs, his innovative work made no sense to them. Finally, a preeminent scholar took a second look and decided that these peculiar jottings had to be true—if only because no imagination could possibly be quirky

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Ramanujan
continued from page 17

enough to invent them. Thus began the astonishly prolific collaboration between two of humanity's most spectacular minds.

G.H. Hardy, the Cambridge don then renowned throughout England as that country's foremost mathematician, may have been the only other person alive at that time who was able, or willing, to recognize the profundity of Ramanujan's visions. Yet, except for their shared love of number theory, Ramanujan and Hardy could scarcely have been more different: Ramanujan was a simple villager and an instinctual mathematician, physically unappealing, often reclusive, devoutly religious. Hardy was a cultured and superbly educated sophisticate, so handsome as to be thought beautiful, urbane and witty, ardently atheistic.

Once convinced of Ramanujan's unique giftedness, however, Hardy went fiercely to bat for him, bringing him to England, securing a position for him at Cambridge, and patiently teaching him the fundamental mathematical techniques to which he had never before been exposed. Hardy's efforts were richly repaid by the sparkling glimpses of transcendental Truth that Ramanujan's uncanny intuition provided.

Tragically, the relationship was a short-lived one. The privations of World War I complicated by his strict vegetarian diet, a strenuous workload, his extreme social isolation, and intransigent British racism combined to jeopardize Ramanujan's physical and emotional health. He returned home to India, where he died in 1920 at the age of 32, having continued his dazzling work to the end.

Kanigel intersperses evocative portraits of life in an Indian village and on the Cambridge campus with carefully constructed explanations of Ramanujan's majestic contributions to the field of number theory—many of which are only now being decoded as contemporary discoveries about our universe expand the perimeters of mathematical knowledge. This is a story that no aspiring mathematician or lover of the exquisitely told tale should miss. ■

THE COACH'S CORNER

by Chengde Feng

Mr. Feng teaches mathematics at the Oklahoma School of Science and Mathematics (OSSM) and has coached many students who have competed successfully in mathematics contests in China and the U.S. In this column, Mr Feng offers *Imagine* readers questions designed to improve their problem-solving skills.

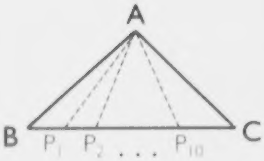
Answers will appear in the January/February 1996 issue.

1. Given: $x = \frac{1}{2}\left(1995^{\frac{1}{1996}} - 1995^{\frac{1}{1996}}\right)$. Find $\left(x - \sqrt{1 + x^2}\right)^{1996}$

2. Given: a, b are positive real numbers such that

$$\frac{1}{a} - \frac{1}{b} - \frac{1}{a+b} = 0.\ \text{Find}\ \left(\frac{b}{a}\right)^3 + \left(\frac{a}{b}\right)^3$$

3. In $\triangle ABC$, $AB=AC=2$, and $P_1, P_2, \ldots, P_{10}$ are ten distinct points on $\overline{BC}$ as shown in the diagram. Find $\sum_{i=1}^{10}(AP_i^2 + BP_i \cdot CP_i)$



4. Let [x] denote the greatest integer that is less than or equal to x. Find the sum of positive integers n such that $[\frac{n^2}{5}]$ are prime numbers. Justify your answer.

5. Given $f(x) = ax^2 + bx + c$ and f(1), f(2), f(3), f(4), and f(5) all are primes. Show that f(x) cannot be factored into two linear factors with integer coefficients.

Disembodiment and Addiction

(continued from p. 24)

since this on-line person is completely created in the mind, it can be or act entirely different from the body. What we have here is very close to total disembodiment: in a virtual community, a real-life man can present himself, using his words, as a woman; an American can pretend to be French; a Jewish scholar can appear as a Christian fundamentalist.

Because being on line leads to feelings of freedom and escape from self, the danger of addiction increases. When we can choose between spending time in a world in which we feel stuck with—let's say—an ugly body or spending time in a world in which we can be glamorous, the choice often becomes obvious. In fact, entire virtual worlds known as Multi-User Dungeons or MUDs have been created for people to play out their fantasies with others around the globe.

Among MUD users, addiction is common. Rheingold tells about one college student who arrived home for the holidays at 2:30 a.m., seven hours late. He had been MUDing all that time, apparently trying to maintain his average of seventy hours a week. Students addicted to MUDs have seen their grades plummet, their real-life friends leave, and their family recede. In fact, many colleges have banned MUDs.

People with addictive personalities may give up one addiction for another once they get on line. Rheingold's friend, Blair, had been addicted to cocaine. After he kicked his habit, someone put a line of cocaine next to Blair's computer while he was on line. Hours later, Blair realized that he hadn't sniffed it. Rheingold explains: "It wasn't a moral decision but a battle of obsessions . . . he couldn't tear his hands from the keyboard and his eyes from the screen of his current, deeper addiction long enough to ingest the cocaine."

Toward the Future: VR and Total Disembodiment

Virtual reality (VR), the technology that offers the greatest potential for disembodiment and consequently for addiction, takes MUDs to a whole new level. Graphics, sound, and even the senses of smell, taste, and touch play a much greater role in VR than they do in on-line computing today. In his novel *Neuromancer*, William Gibson predicts a future where virtual reality has evolved to the point where it incorporates all the senses. This futuristic, fictional VR is for all practical purposes *complete* disembodiment.

The VR in Gibson's future is hooked directly to the brain; the body is not used at all. Thus the mind has absolute freedom, rather than the pseudo-freedom the mind now has during an on-line computing session in which the hands and eyes play an integral part. Virtual reality becomes, in effect, a drug, a sort of controllable acid trip. And when we experience the complete unleashing of all physical boundaries—of the body, space, and time—going back to the physical world is bound to be hard.

The main character of *Neuromancer* is Case, a "console cowboy," who is addicted to cyberspace. He spends much of his day in cyberspace—hacking, exploring, searching, *living*—until the day he double-crosses the people he works for. They inject him with a chemical that prevents him from accessing cyberspace, and he experiences withdrawal. Gibson describes this longing:

> *"A year here and he still dreamed of cyberspace, hope fading nightly. All the speed he took, all the turns he'd taken and the corners he'd cut in Night City, and still he'd see the matrix in his sleep, bright lattices of logic unfolding across that colorless void. . . . The sprawl was a long strange way home over the Pacific now, and he was no console man, no cyberspace cowboy. Just another hustler, trying to make it through. But the dreams came on in the Japanese night like livewire voodoo, and he'd cry for it, cry in his sleep, and wake alone in the dark, curled in his bedslab, temperfoam bunched in between his fingers, trying to reach the console that wasn't there."*

The more disembodied we become, the more addicted we become to the device creating the disembodiment. The machines effectively become our body, and we are dependent on them.

Typewriters began our obsession with writing where our hands weren't. On-line computing allowed us to have a voice without a body and gave us the anonymity and freedom to disseminate our ideas widely. MUDs gave us the chance to create entire characters and play out our fantasies in text-based virtual worlds. (Some people now spend as much time playing their MUD character as they do being their real-life selves.) Finally, the virtual reality of Gibson's future would allow us to bypass the body completely and create an entire world with our minds that would cater to all five senses.

The addictive potential of VR is frightening, since the ability to be whatever we want to be will hook us even more when all our senses are involved. Whether this addiction to VR can be utilized in a good way has yet to be determined, but one thing is certain: we *will* have cyberspace junkies in the future. ■

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Gibson, William. *Necromancer.* New York: Ace, 1984.

Rheingold, Howard. *The Virtual Community: Homesteading on the Electronic Frontier.* Reading: HarperPerennial, 1993.

This essay reflects some of the critical thinking that emerged from a course entitled "Explorations of Text-Based Virtual Reality," which ***Jason Kirschner*** *attended during the Johns Hopkins Pre-college Program last summer. When not exploring the relationship between disembodiment and addiction, Jason enjoys playing tennis, producing the school newspaper, and participating in the National High School Model United Nations. An 11th grader at Germantown Academy in Fort Washington, Pennsylvania, he also runs a part-time computer consulting business. Drop him an e-mail: theseer@netaxs.com*

FASCINATING CLASSICS

MIDDLEMARCH

by George Eliot

Review by Lesley Mackay & Carol Blackburn

Lesley: What a change—from misadventures on the high seas and in the rainforest in our last book, Joseph Conrad's *Lord Jim*, to the not-so-action-packed lives of genteel young people in George Eliot's quiet mid-1800s English town of Middlemarch. Conrad's Jim put great stock in his passionate desire to be a hero. Readers will remember that his dreams sometimes clashed painfully with reality.

Carol: In *Middlemarch*, we also watch youthful dreams bump up against reality, as several young people make their first forays into the world. Although we might imagine that reality in a provincial English town would be benign, Eliot's characters do suffer the slings and arrows of misfortune. Her rich social tapestry offers an engaging opportunity to compare and contrast characters and their destinies.

Lesley: After having read *Lord Jim*, I almost felt afraid for Eliot's hopeful and, in some cases, idealistic young people. I was especially interested in the fate of her vibrant heroine, Dorothea, who restlessly looks for ways to do good.

Carol: Eliot's heroine is driven by humanitarian beliefs and desires. Unfortunately, she lives in a time and place that provide no obvious outlets for her ardent nature. The dearth of opportunity leads her to make some odd choices. Dorothea gives us our first glimpse of one of Eliot's themes: the powerful role one's opportunities play in shaping the expression of one's nature.

Lesley: *Middlemarch* gets off to a shocking start with Dorothea's marriage to a middle-aged scholar who is not able to open up his heart to her. She places such a high value on self-sacrifice that she is unable to see that marrying Mr. Casaubon is one noble act that will never pay off. It's terrible to read about this twenty-year-old settling into the musty house of a rigid, solitary man. At this early point, I found Dorothea a little ridiculous.

Carol: I found her poignant. She sees the marriage as her best chance of entering into the world of learning, where she hopes to find answers to her deepest questions. The fantasy that her husband will provide those answers is quickly shattered, however, as she discovers that "the large vistas and wide fresh air which she had dreamed of finding in her husband's mind were replaced by ante-rooms and winding passages which seemed to lead nowhither."

Lesley: Eliot makes us wait hundreds of pages to find out what the future holds for Dorothea. In the meantime, the novel introduces us to several other young Middlemarch residents. Lydgate, a serious and bold young physician, also desires to play an active part in making a better world. Others, like the Vincy siblings, Rosamund and Fred, are wrapped up in desires for an easy life.

How will their lives unfold? And who will marry whom? While suspense and great interest color her stories of courtship and early marriage, Eliot does not use love and romance just for interest or to drive her plot.

Carol: You're right. The novel suggests that the choice of a spouse shapes not only one's destiny, but also one's ability to respond well to what chance, luck, or error may bring. In many novels, the heroine's marriage would be the end of the story. In *Middlemarch*, both major protagonists, Dorothea and Lydgate, marry in the first half of the book. Eliot is interested in looking beyond the wedding day, beyond the innocent assumption that marriage produces a happily-ever-after ending.

Lesley: It's interesting to watch Eliot's couples pair off; it can be quite surprising to see who ends up with whom. On the other hand, there's always a reason why people get together. For example, Fred Vincy is vain and lazy, but there is a side of him that wants to be honorable; that is the side that is attracted to Mary Garth. And while Lydgate is serious and studious, what he longs for in a wife is "that feminine radiance . . . which must be classed with flowers and music"; this is the side of him that is captivated by Rosamund.

The first couple I mentioned, Fred Vincy and Mary Garth, are not prominent in the novel, but nevertheless they are very important. I think that these two fictional young people were close to Eliot's heart. Their story line is like a parable illustrating the central Christian ideals of forgiveness and redemption.

Carol: In some ways they seem a mismatch. Mary is one of the finest characters in the book, while Fred is guilty of some very weak behavior.

Lesley: That's true. Fred doesn't really deserve Mary. And here I think the novel suggests that love is not determined by what individual people may or may not deserve. The friendship between Mary and Fred is very strong; it dates back to their childhood. As a young adult, he acts selfishly, but Mary has a great capacity for forgiveness.

Both Mary and her father treat Fred like a prodigal son; they look beyond his mistakes and even his selfishness. They act lovingly toward him in accordance with their belief that he can become a better person.

Carol: There is a strong element of undeserved good fortune—of grace—in Fred's story. With the Garths' support, he grows into a much better person than his parents raised him to be.

Not everyone is so fortunate. Dr. Lydgate seems to get more than his fair share of trials. Like Dorothea, he is concerned about the well-being of others. But his good intentions are sorely tried by a series of discouragements and setbacks.

Lesley: Well, I think Lydgate is quite arrogant. He has come to Middlemarch as a doctor who must build a practice. He needs to win friends and influence people. But he feels superior to the very people whom he seeks to serve. No wonder they don't flock to him.

Carol: I have to agree that he brings some of his troubles upon himself. He can be arrogant, and that does cost him goodwill. On the other hand, his belief that he knows better is not unjustified. He **is** the best educated doctor in town. Middlemarch residents, however, are more concerned with a man's business partners and family background than on his expertise. (*Middlemarch* is filled with Eliot's ironic running commentary; at one point she observes that in good Middlemarch society "it was dangerous to insist on knowledge as a qualification for any salaried office.")

One could argue that Lydgate needs to have his wings clipped a bit, that he would benefit from a little more humility. But most of the discouragement he receives has less to do with his character flaws than with his fellow townspeople's resistance to having their set, comfortable ways challenged.

Lesley: The distinction between what's comfortable and what's not is constant throughout the novel. Of course, there is material comfort, affluence, which several characters are concerned about. But there is also the comfort of not having one's beliefs, lifestyle, or customs challenged. Some characters, like Lydgate and Dorothea, can't seem to do anything without shaking people up.

Carol: Sadly for him, Lydgate marries a woman, Rosamund Vincy, who refuses to budge an inch from her self-centered ways. She has no understanding of the deeper concerns that fuel his ambitions; rather, she marries him because she believes he has good social and economic prospects. When success eludes him, she feels wronged and turns on him. Unlike her brother Fred, Rosamund lacks the compassion or the inner strength to mature. If Fred and Mary show us how a supportive relationship can enhance one's strength to face life's trials, Rosamund and Lydgate offer a painful portrait of how an unsupportive union can undermine that strength.

Lesley: In his difficulties, Lydgate attracts the advocacy of the character in the novel with whom he has the most in common—Dorothea. She finds a real opportunity to do good when Lydgate suffers a terrible blow to his reputation.

As I admitted earlier, there were times when I found Dorothea a little silly. At one point, her sister Celia reproaches her, "You always see what nobody else sees—it is impossible to satisfy you; yet you never see what is quite plain." I think Celia's right. There is something almost perverse about some of Dorothea's perceptions, judgments and decisions. But over the course of the novel, she becomes more adept at choosing and fighting her battles. When she steps in to help Lydgate, she is not throwing herself away, but applying her strengths wisely.

Carol: Yes, it's wonderful to see her spring into action when she can finally do some real good; she acts with great courage and dignity. And you're right that, with time, she develops a better sense of how and when to intervene in the world around her. But she never becomes fully "socialized"—she never accepts that Middlemarch morality knows better than she does. Throughout the novel, Dorothea is driven by her own moral intuition—"the reaching forward of [her] whole consciousness towards the fullest truth, the least partial good." She doesn't often succeed, but her failures never make her doubt her own moral compass.

Lesley
Mackay
Carol

Lesley: That brings up an interesting comparison between the moral visions of Eliot and Jane Austen. In *Emma*, which we covered in this series last year, Austen suggests that one can receive a full moral education by heeding the influences and dictates of society. As you point out, Eliot doesn't share this faith in the community's moral instruction.

Eliot is, however, at least as interested in moral education as Austen is. It's just that for Eliot, moral education is spiritual, not civic. It flows from a groundspring of faith. "Faith is the substance of things hoped for, the evidence of things not seen"—these words from the Bible articulate an essential driving force within Dorothea. Seen in this light, her excesses and errors make more sense. It is hard to translate the invisible things we hope for into something real.

Carol: The comparison with Austen is a good one. And you're right; for Eliot, the spiritual dimension of morality is much more important than the civic one. *Middlemarch* portrays a number of characters who try to realize demanding personal visions. Some, like Mary Garth, are quite successful, while others with more complex aspirations, like Lydgate and Dorothea, are more disappointed than satisfied. As Eliot writes, Dorothea felt "that there was always something better which she might have done, if only she had been better and known better . . . "

Lesley: Reading this novel, we can appreciate the many limitations Dorothea encounters despite great intelligence, energy, and even personal wealth. As a woman, she has no opportunity to live a life like Dr. Lydgate's in which she can work for good causes through a profession. Instead, she has to look for back doors and winding alleys that will lead her to the opportunities she wants.

Carol: She never stops looking, though. While Dorothea may be disappointed with the fruits of her efforts, Eliot's compassionate gaze sees more than Dorothea sees. In the eloquent postlude, Eliot reflects that Dorothea's "full nature spent itself in channels which had no great name on the earth." By now, however, we know how little Eliot trusts the world's estimation of greatness. Eliot ends her novel honoring her heroine: "But the effect of her being on those around her was incalculable: for the growing good of the world is partly dependent on unhistoric acts . . . and [on all those] who lived faithfully a hidden life, and rest in unvisited tombs."

Lesley: Eliot's masterpiece concludes with a subtle, but powerful, redefinition of human heroism. "That things are not so ill with you and me as they might have been" is due in large part to quiet heroes like Dorothea, who, while they may not realize their dreams, accomplish much more than they know. ■

Tired of reading about these quiet, gentle types with good intentions? Our next 19th-century classic, ***The Mayor of Casterbridge,*** by Thomas Hardy, explores a darker side of human nature.

Lesley Mackay, who holds a B.A. from the College of William and Mary and an M.A. in English from Indiana University, is IAAY's Staff Writer.

Carol Blackburn, who holds an M.A. in counseling psychology from Pacifica Graduate Institute and a Ph.D. in pharmacology from The Johns Hopkins University, is Senior Research Associate at the Study of Exceptional Talent.

STUDENTS REVIEW

RICE UNIVERSITY

College Review Series

This on-going series is intended to aid prospective college students in their search by offering insiders' views of selected colleges and universities, as expressed by current undergraduates or recent graduates who have exceptionally high academic ability. Our reviewers all share high expectations for a college's academic standards and its nurturance of emerging talent.

Note that the number of student reviewers is small. Consider their personal perspectives as only one component while you gather factual information and impressions from such other sources as college catalogues, site visits, talks with officials and students on campus, and the advice of your guidance counselor and teachers.

Rice University

Our reviewers include eleven students, who major(ed) in chemical physics (1), chemical engineering (1), chemistry (1), computer science (1), electrical engineering (1), history (2), math (3), music theory (1), physics (2), psychology (1), and Spanish (1). (The number of majors exceeds eleven because several students have double majors.) Students' comments appear within quotation marks.

Quality of Academic Instruction for Undergraduates

Reviewers were unanimous in their praise for the undergraduate education Rice offers in math, science, and engineering, commending the faculty for both their teaching and advising.

"The quality of instruction is, without a doubt, one of Rice's strongest points. Rice combines the atmosphere of a serious (albeit small) research institution with the personal attention of a small college. Rice is not strong in every field; in particular, some of the humanities and social sciences are lacking. Some departments tend to concentrate on their upper-level courses at the expense of the introductory ones (although Intro. to European History was one of the best history classes I took). I've been happy with and challenged by most of the courses I've taken here. Most professors really care about and are open to their students."

"Wonderful! Professors are, for the most part, very willing to help students both academically and with future goals. Research and other advanced opportunities for undergraduates are easy to find. Because the graduate school at Rice is so small, professors are eager to get undergraduates involved, and graduate courses are completely open to ndergrads. Higher-level courses in math and her sciences are of uniformly high quality."

"I found the Rice faculty to be wonderfully elpful, routinely going out of their way to make life easier or better for students. Courses (at least in science) tend to cover extensive ground with good depth; they constitute an exemplary and rigorous preparation for graduate school."

"The instruction is excellent. An atmosphere of moderate informality makes it very easy to meet with top professors to discuss class material. Some professors live on campus, and many more regularly dine with students."

"Accessibility to senior professors is very good, especially in comparison with that at many other universities. The required core for science students is pretty well done; first-year chemistry and physics are the only large lecture classes. (The required science classes for non-science majors, on the other hand, are terrible.) There are definitely enough challenging higher-level courses available; however, as at any small school, the limited selection of expertise within a department can sometimes feel restrictive."

"Computers are plentiful and free (and open 24 hours!). Rice's library is inferior to those of many comparable schools; however, if you have a car, the University of Houston and the Medical Center libraries are excellent supplements."

Social Life

Rice's residential college system—the heart of its social life—was praised by all reviewers as providing an immediate and comfortable social support system for students.

"Social life is dominated by the college system. Each of the eight residential colleges has a faculty family and two resident associates, typically single professors, who live in the college. The tight camaraderie within each college is due, in part, to the rivalries between the colleges, leading to such diverse events as midnight 'borrowing' of another college's Christmas tree or challenging another college to an afternoon of laser tag."

"Social life revolves around the residential colleges, to which incoming students are randomly assigned. Everyone is a member of a college, whether or not they live on campus. About 80% of the students live in their college, and nearly all eat in their college cafeteria. You stay in one college throughout your time at Rice, and the colleges organize all kinds of activities. Fraternities and similar organizations are prohibited; the colleges take their place. Most students are very happy with this system."

"The college system is fantastic; it's what makes Rice really distinctive. It instantly immerses you in college rivalries, activities—all sorts of great silliness. The colleges have all the good points of a fraternity or sorority (lots of parties and organized activities, a preselected group of friends who will always be around) without the bad points (e.g., the popularity contest of rush)."

"The residential college system is very successful at providing students with a small group to identify with and opportunities to get to know students with diverse interests. Every college is certain to have music majors, varsity athletes, foreign students, etc., and this diversity really contributes to college life. On the other hand, this arrangement makes it difficult to become good friends with the students in other colleges who might be the most like you—it does take some effort. However, once you're in upper-level courses, where the class sizes are much smaller, it's easier to get to know your fellow majors in other colleges."

"The big spring campus-wide event, the annual Beer Bike (which includes both bicycle racing and beer chugging), tells you something about Rice. Yes, it's an intrinsically silly thing, but we do it, so we're going to do it well. Rice is not a back-breaking school, but the atmosphere is not friendly to underachievers."

"I loved life at Rice. Houston offers museums, ballet, symphonies, opera, concerts, pro sports, etc. (And student ticket prices make it possible to attend many such events.) Rice is a small school, so getting off-campus is necessary for anyone who wants to experience wider opportunities. On campus, weekend dorm parties are the norm, as

are cheap movies in the lecture halls. Intramural sports are big—everyone plays something. In general, students are very accepting, and there is a place for everyone."

"There is a prominent division between 'work' and 'play' at Rice. The ethos is to work hard, then **put it down.** *For a student like me, who enjoys being able to walk away from his work, this is ideal."*

What Do You Like Least about Rice University?

"The strong academic resources and general friendliness of the students."

"The top-rate academics and an extracurricular structure that encourages student leadership, creativity, and initiative. Students, not adults, produce and direct much of the theater on campus. The students elect an Honor Council of students who oversee all disciplinary cases. (The administration turns a blind eye to the unofficial 'club' that streaks around campus wearing only shaving cream once a month.) The students have a huge hand in running the university."

"The amount of help and advising available—from the academic advisors, to the faculty and TAs, to the masters and RAs who live in the colleges—is outstanding. Advisors make sure that their freshman advisees take appropriate placement tests, are making friends, and are handling the transition to college. My advisor talked through some big academic decisions with me."

"Rice does not have the stature of Harvard, so it must work harder to get top students. This is visible in the school's financial aid policies. Harvard makes it financially possible, but not easy, for anyone who is accepted to attend; on the other hand, if Rice wants you, they will make it easy for you to attend."

What Do You Like Best about Rice University?

"Rice is small. With approximately 2,500 students, by the time you leave, you sort of know everyone. And the college system means you really do know everyone in your college. Its size can lead to an almost high-school atmosphere."

"Although Rice is a good school academically, I feel that it has a less 'intellectual' atmosphere than many other similar schools. I haven't had the kind of serious academic discussions that I enjoyed at talent search summer programs or at my math/science magnet high school. I have made many good friends at Rice—people who have challenged me in ways other than academically—but they are not the kind of friends who want to hear about my research."

RICE UNIVERSITY

Houston, TX 77251
(800) 527-6957

- 4-year private coed university
- Campus in a quiet suburban neighborhood
- Full-time undergraduate enrollment 1994-95: 1,465 men, 1,191 women.
- Special Feature: Rice-Baylor Medical Scholars Program—High school seniors admitted to Rice are eligible to undergo a second application process. Students accepted to the RBMS Program complete a full undergraduate education at Rice and are guaranteed admission to Baylor upon graduation from Rice. They must fulfill undergraduate premedical requirements, but can major in any subject.

"Students who have attended extremely high-caliber high schools or summer programs may be disappointed by Rice's slightly less focused intellectual atmosphere. But I find the discussions I have with my friends very interesting. We love to jabber on about things we learned that day."

Who Would Be Most Compatible with the Academic and Social Atmosphere at Rice University?

"The academic atmosphere at Rice is competitive and demands a person who is smart and motivated to learn. On the other hand, it is not cutthroat (with the possible exception of a few fields in which I have not taken courses and am not qualified to comment). The people who thrive here are bright and outgoing, with an enthusiastic desire to learn."

"I think that many of the happiest Rice students are those from Texas and the South, while students from the Northeast may be disappointed by the difficulty of public transportation and the lack of 'cosmopolitanness' of Texas."

"A notable feature of the Rice student body is its conservative character; the stock market draws far more attention than apartheid. You will not meet charming oddballs here. You will not discuss the meaning of life over coffee at 5 a.m. Most Rice students are less socially deviant than I had, before my arrival, imagined intelligent people could possibly be."

If You Had It to Do over Again, Would You Go to Rice University?

All reviewers said yes.

"Absolutely! No questions asked. These have been the best years of my life."

"Absolutely! I loved Rice. I learned an amazing amount, both academically and about myself. I also had a ton of fun and came away with the spirit of Rice: academics aren't everything. Rice costs far less than comparable elite private schools in the East. All things considered, Rice offers a beach 45 minutes away, friendly Southerners, Mexican food, and lots of sunshine."

"Absolutely. My final choice was between Rice and an Ivy League school. I chose Rice because (in addition to its being $15,000 less per year) I thought the professors would be more accessible and the people friendlier. I was right."

"Yes. I met interesting friends and was quite happy. I strongly recommend the school to those looking for a blend of academic excellence and relaxed, friendly society."

"Yes, almost definitely. I originally chose Rice partially for financial reasons (I got a full-tuition scholarship). But Rice would have been a very good choice for me even without the financial incentive."

CAVEAT: As you try to find the college or university best suited to you, the views of Rice presented above may be helpful. Keep in mind that these students might have had similar positive or negative experiences had they attended a different university. At any college, it is important for the individual student to seek out challenging academic experiences and the best professors and to create a social life that best fits his or her personal style. ■

Note: The students quoted in the College Review Series are expressing their own views, which are not necessarily those of JHU or IAAY.

CREATIVE MINDS

ImaGiNe...

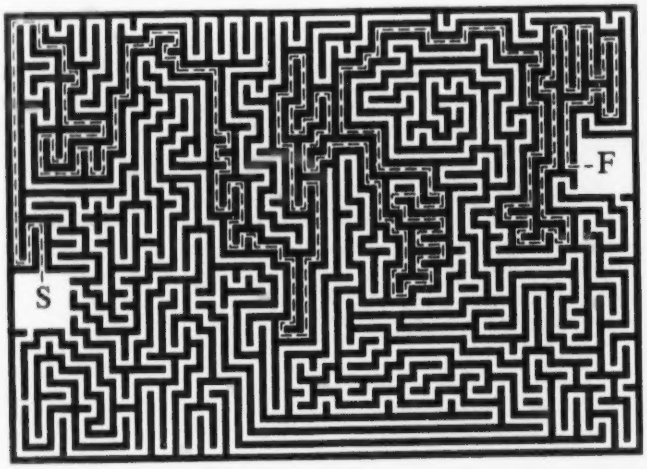
Submit your creative work—brain teasers, short stories/essays/book reviews. We look forward to hearing from you.
Please write to *Imagine* • SET at IAAY • The Johns Hopkins University • Baltimore, MD 21218

Fascinated by mazes and puzzles, ***Tim Boester*** *is also intrigued by roller coaster design. Tim is a sophomore at the University of Chicago, where he is studying physics and math.*

SOLUTION TO MAZE

IN THE SEPTEMBER/OCTOBER ISSUE

by Tim Boester



WANTED: PUZZLE MEISTERS!

Much as he loves creating puzzles for *Imagine*, Tim Boester feels that it's time to pass the mantle on to younger readers. We will feature puzzles by Tim in the remaining issues of the 1995-96 season, but after that, it's up to you!

Please put on your thinking caps and send us brain teasers of any kind—puzzles, mazes, riddles, minute mysteries—whatever you think would be appropriate for this column. We're looking forward to hearing from you!

On this page in our March/April 1995 issue, Daniel Slosberg extolled some of the virtues of cyberspace and the opportunities it provides to create one's own world. Here, another **Imagine** *reader offers a glimpse of the dark side of cyberspace. What's your opinion?*

Disembodiment and Addiction

by Jason Kirschner

In the past century, technological developments have occurred at a startling rate. Ever since the typewriter appeared in 1873, we have seen myriad new gadgets designed to make our lives easier.

But some of these devices have also done something very new to humankind: they have disembodied us. The typewriter, radio, telephone, television, computer, and virtual reality have all in some way or another separated our body from our mind. And the more technology disembodies us, the more addictive it becomes.

When Christopher Latham Sholes invented the typewriter in 1873, he probably had no idea that he was creating one of the first devices that could distance the mind's intentions from the body. Moreover, the notion that someone could become addicted to a typewriter would have sounded crazy to him. All it did was create impressions on paper, right?

In fact, typewriters did much more than that. As Scott Bukatman notes in his essay, "Gibson's Typewriter," "Typing produces an information space divorced from the body: a proto-cyberspace. The hands appear *here*, while the writing appears *there*." The machine performs what the mind intends, almost *becoming* a part of the body.

The On-line Revolution

On-line computing furthers the progress of disembodiment that typewriters helped start. Writing created with a typewriter must be transported physically via paper, and its dissemination on a broad scale requires considerable time and effort. With on-line computing, not only are the writing/hands separated from the mind, but this writing can be spread in real time to millions of people over networks that span the world.

On-line computing is also more disembodied than the telephone. As Howard Rheingold writes in *The Virtual Community*, "The telephone has more physical presence, more of a direct sense of the living being behind the words." But in Internet Relay Chat, "[w]ords, and the elegance of expression and timing that accompanies their use, exist in a purely disembodied state."

Increased disembodiment allows us to feel freer to do what we want to do. People who do not feel accepted in the real world can become, in essence, a new person just by appearing on line. And

(continued on p. 19)

VOLUME 3, NUMBER 3

Opportunities and Resources for Academically Talented Youth

January/February 1996

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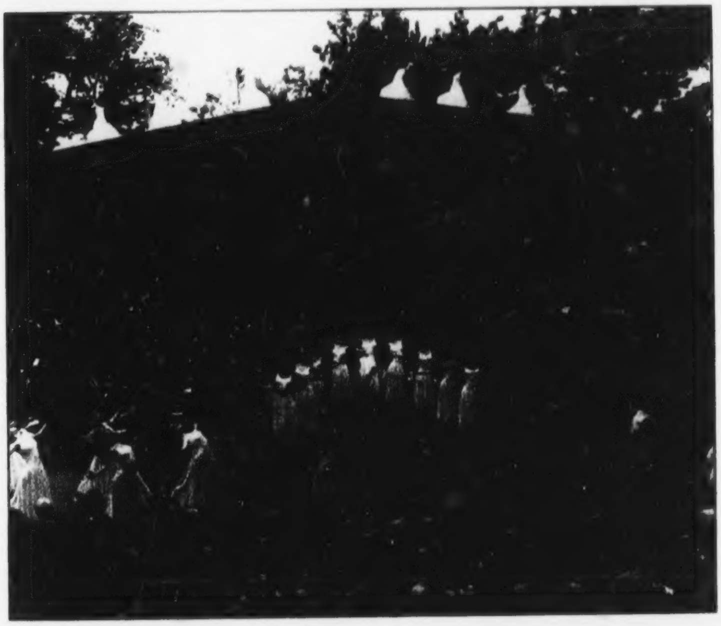
IAAY

Spotlight On

DEVELOPING TALENT IN THE ARTS



At Interlochen Arts Camp, the summer's final performance is always Liszt's *Les Préludes* (see p. 6)

THE ARTS—what do they mean to you? A startling array of Impressionist paintings at your nearest museum? The tranquil investigations of a simple Chopin nocturne? Or your own efforts to sing, to dance, to paint, to sculpt . . . to create? The arts resonate within each of us, perhaps more vibrantly than we know. They touch us with their historical significance, contemporary influence, and promise for the future. How will Shakespeare—or Shostakovich—be performed in the next century? What new forms will portrait painting take? Aspiring artists live and breathe such questions.

This issue of *Imagine* focuses on the broad spectrum of the arts—not only for serious artists, but for those among you whose relationship with the arts may be less direct. Along with information on arts programming in schools, and summer programs here and abroad, we offer an exploration of the links between music and math. And in our Career Options series, we interview someone whose lifework requires both artistic talent and scientific interest and knowledge: a medical illustrator.

The arts are an integral part of human experience and understanding. Whether simply appreciated or rigorously practiced, they have a vital role to play for each of us. Read on to find out about the intriguing ways in which the arts affect very different lives. ■

Mark Your Calendar

. . . with these March-May registration deadlines for selected academic competitions.

DEADLINE	COMPETITION
March 9	**USA Computing Olympiad Competition Round:** Dr. Donald Piele, University of Wisconsin-Parkside, P.O. Box 085664, Racine, WI 53408; (414) 634-0868; e-mail: piele@cs.uwp.edu; web: http://usaco.uwp.edu/
April 1	**Knowledge Master Open** (Schools enter one team per division–middle, junior high, high school): Academic Hallmarks, Box 998, Durango, CO 81302; (800) 321-9218 or (970) 247-8738; fax (970) 247-0997.
late April	**American Regions Math League** (Teams register; grades 7-12): Mark E. Saul, ARML President, 711 Amsterdam Avenue, New York, NY 10025; (212) 666-5188.
May 1	**Texaco Star National Academic Championship** (To enter, teams must have won a regional or state competition involving 16 schools; grades 9–12): Chip Beall, Executive Director, 8334 Breckenridge Way, Columbus, OH 43235; (614) 848-5113.
May 15	**USA Mathematical Talent Search (USAMTS)** (Individuals enter for 1996-97 school year): Dr. George Berzsenyi, Department of Mathematics, Box 121, Rose-Hulman Institute of Technology, Terre Haute, IN 47803; (812) 877-8474/8391; fax (812) 877-3198; e-mail: george.berzsenyi@rose-hulman.edu **Correction:** Please note change in e-mail address from that given for the USAMTS in our November/December issue.

Note: The 15-year-old International Computer Problem Solving Challenge (ICPSC) is no longer being offered. The competition's organizer, Dr. Donald Piele, has decided to devote all his outside service time to the USA Computing Olympiad. He advises that students with advanced computer skills have two good reasons to accept the USACO challenge: it's free, and this year's winners will receive an all-expenses-paid trip to Hungary to compete in the 1996 International Computing Olympiad.

Looking at Colleges?

Whether you're an 11th grader narrowing down your college choice, or a middle schooler just beginning to explore your options for the future, our College Review series provides worthwhile information from the student's point of view.

In this issue, we profile Berkeley. Past reviews have included (Volume 1) Stanford, Washington University (St. Louis), Johns Hopkins, Yale, and Brown; (Volume 2) Princeton, University of Michigan, Amherst, Columbia, and MIT; and (Volume 3) Harvard and Rice. The Johns Hopkins University Press will furnish back issues from Volume 2 for $3 per copy and from Volume 3 for $5 per copy, while supplies last. Call (800) 548-1784 to order. To obtain photocopies of reviews from Volume 1, please call (410) 516-0310.

Considering the Westinghouse?

The forty finalists in the 1996 Westinghouse Science Talent Search will exhibit their projects at the National Academy of Sciences in Washington, D.C., on March 9 and 10 from 1:00 to 4:00 p.m. The public is welcome to attend; aspiring Westinghouse competitors will particularly enjoy seeing and discussing these exhibits with their creators.

Imagine...
*Opportunities and Resources for Academically Talented Youth**

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A Palette of MANY OOS

Brightening Your Life with Training in the Arts

Honoring the Artistic Impulse

Arts are the primary connection with the imagination, the place where life evolves.

—*Daniel Windham, Director of Educational Activities, New York Philharmonic Orchestra, 1991*

Have you ever seen works of art produced by early civilizations? Perhaps you've been lucky enough to enter an ancient cave whose walls are etched with primitive drawings. Or maybe you've visited a museum that displays cups and bowls decorated with rudimentary geographic designs or millenia-old copper jewelry.

Why did our human ancestors, who led short, difficult lives teetering on the brink of calamity, develop the impulse to create art? What inspired them to turn from the crucial daily tasks of survival to conceive and execute artistic forms?

And what about contemporary humans? Why do we appreciate art and cultivate our understanding of its diverse forms, sometimes without being aware of it? Even if art is not your greatest passion, think about the vast repertoire of music you are familiar with, how engaged you were by your earliest dance classes, how you valued your first set of colored pencils and sketch book.

The artistic impulse. We know that this energy exists and that since prehistory it has motivated legions of human beings to express themselves creatively. The "art spirit"—as twentieth-century critic Robert Henri named it—blows not only through each culture but through the lives, perceptions, hopes, and dreams of every individual.

Arts Education & You

Art is a way of thinking; whether conscious or subconscious choices are made in the creation of art, there is a finely attuned aesthetic involved in the choices made, in the problems solved. By encouraging, from the very beginning, the exercise of free imagination, analysis, systematizing and ordering, we can extend that way of thinking into all subjects.

—*Jane Alexander, Chairman, National Endowment for the Arts, 1995*

Countless young people spend time each week on stage, on their toes, or with artists' brushes in their hands. Some of them aspire to a full-fledged career in the arts. But not all do. Most young pianists are not headed for musical careers. Most young actors are not planning a life in the theatre. Most young men and women in ballet classes—even the advanced ones—are making other plans for their lifework.

Whether your artistic impulses lead you toward art as a career, art as a tool for building interdisciplinary understanding, or art as aesthetic enrichment, you enjoy a range of choices for training and personal development. You may make a full-time commitment by, for example, attending a private academy or a magnet school that treats artistic skill as a basic component of students' growth and development. Alternatively, you may prefer to throw yourself into art outside school.

Your options may be shaped by considerations such as living area, time available, and financial resources. The road towards excellence in the arts might, for example, seem wider, smoother, and better lighted in some parts of the country than in others. But you can employ your imagination and resourcefulness to secure valuable opportunities no matter what your particular circumstances.

Let's consider some examples.

If you have a real hunger for artistic development, you may want to consider full-tilt dedication. Schools for the arts, like other magnet institutions, allow students with similar passions to collaborate and learn from each other. Arts schools also typically demonstrate a strong commitment to fostering mentor relationships between the teachers and visiting artists and their students. The strong, guiding influence of an experienced master is, of course, at the heart of classical apprenticeship in the arts. The benefits of such a relationship simply cannot be measured.

You've heard of creative hubs like the Juilliard School in New York City. Such top-notch private academies draw students from across the nation and maintain stellar reputations through excellent teaching and, of course, rigorous selection processes based on highly competitive auditions.

Some individual states have established arts institutions that are also well worth considering. The North Carolina School for the Arts, located in Winston-Salem, offers training at both high school and college levels. Participants in this largely residential program, which also accepts out-of-state students, obtain academic credentials in the sciences and humanities while refining their artistic expertise. Creative options include performing in jazz ensembles, producing films, designing theatre sets, singing, acting, and working in the visual arts. Such programming incorporates both the behind-the-scenes labor and the in-the-spotlight thrill that are integral to artistic accomplishment.

Some of our larger cities have incorporated magnet schools for the arts into their public school systems. One example is the Baltimore School for the Arts, where five hundred aspirants audition every February for about ninety openings in the fall's freshman class. These spots are divided among four departments: dance, music, theatre, and visual arts. Those who manage to calm their nerves and outshine their competitors are invited to attend this municipal high school with an arts focus—and to benefit from an unusual and inspiring set of teachers and peers.

Your hometown may also include institutions that offer top flight part-time training in the arts: a conservatory, arts academy, community center, museum or other site where you may take classes to develop your artistic background and skills.

You may want to consider seasonal options. Special summer sites for artists, such as Interlochen and Tanglewood (pp. 6 & 7), facilitate your chance for full-time, if temporary, creative discipline. Among other possibilities are governors' schools for the arts, available in some states.

Even if formal training is not available, vital community efforts can supply contacts and opportunities—at no cost. Church choirs sometimes boast fabulous singers. Community theatres are often populated by experienced actors. Many museums sponsor special programs that bring together a region's artists. It's up to you to recognize and make the most of what your community has to offer.

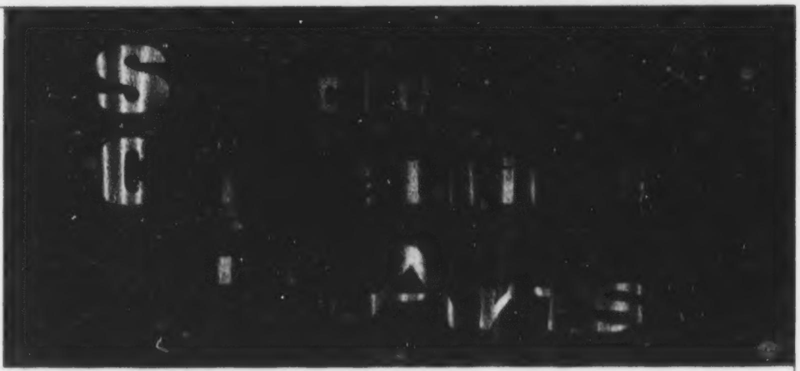
The Arts: Essential to Your Education

Arts in schools are not just training grounds for artists or the emotions; the arts develop the human capacity for language and criticism.

—Daniel Windham, Director of Educational Activities, New York Philharmonic Orchestra, 1991

It doesn't matter whether you are an appreciator or a practitioner, a music historian or a career performer. As in all fields of learning, your artistic development will take off when you take the initiative. Identify and secure your own opportunities. Take charge of your own development. Bear in mind that both group and one-on-one learning experiences are indispensable to cultivating your skills and artistic enthusiasm. And don't forget to revel in the exhilarating and supremely human activity of appreciating art. ■

If you're a serious student of music, you're already familiar with performance competitions such as those sponsored by the National Guild. And if you enjoy drawing and cartooning, you probably keep an eye on announcements of theme poster contests sponsored by national organizations. But, here are two national competitions concerned with the broadest spectrum of the arts.



SCHOLASTIC ART AWARDS

Grades 7-12

Founded in 1923, The Scholastic Art & Writing Awards program is administered by the Alliance for Young Artists & Writers, Inc., and is the nation's largest and longest-running recognition program of its kind. Last year, over 14,000 art entries were submitted for national judging. Of these, about 650 entries earned over $350,000 in awards and scholarships, and 225 were displayed in The Scholastic Art Awards National Student Art Exhibition at the Corcoran Gallery of Art in Washington, D.C.

Young artists may submit original work in a tremendous variety of categories:

- **Fine Arts:** Painting, Drawing, Mixed Media, Printmaking, Sculpture, Photography, Computer Graphics; Video, Film, & Animation.
- **Design:** Environmental Design; Communication Arts & Graphic Design.
- **Crafts:** Ceramics, Jewelry & Metalsmithing; Textile & Fiber Design

Portfolios: Art; Photography (Portfolio Awards and Scholarship Nominations are open to students who will graduate in 1996 and plan to attend college.)

Deadline: Varies with category.

Alliance for Young Artists & Writers, Inc.,
555 Broadway, 4th Floor, New York, NY 10012;
(212) 343-6892, fax (212) 343-6484.

Note: Writing competitions, including the Scholastic Writing Awards, will appear in our May/June issue.

ARTS: ARTS RECOGNITION & TALENT SEARCH

Graduating high school seniors

(Must be a U.S. citizen or have announced their intention to become one.)

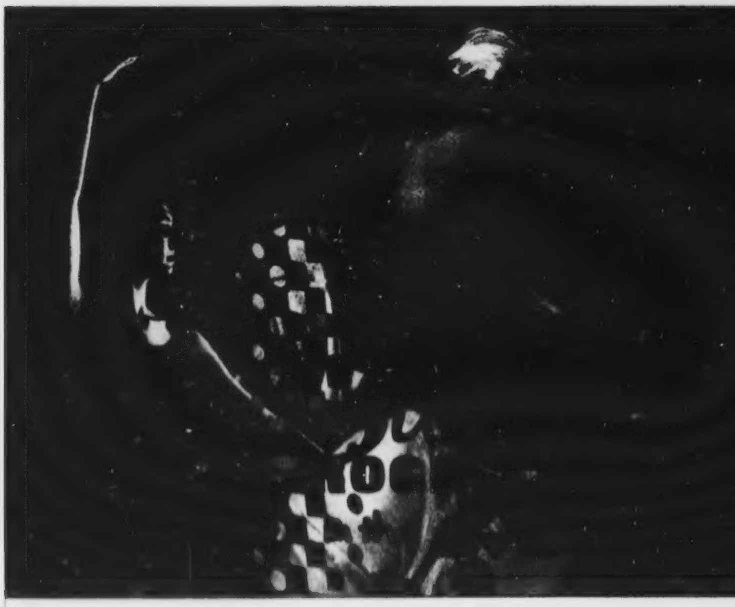
An annual program of the nonprofit National Foundation for Advancement in the Arts, ARTS identifies and rewards artists who are exceptionally talented in the fields of dance, music, jazz music, theatre, visual arts, and writing.

- Of the more than 5,000 young artists who apply each year, about 250 receive awards in the amount of $100 to $3,000. About 100 finalists are invited to participate in ARTS Week: five full days of judged individual auditions, workshops, master classes, and seminars, held annually in Miami during the second week of January.
- All students who participate in ARTS are also eligible for more than $3,000,000 in scholarship opportunities offered by nearly 150 colleges, universities, and professional arts institutions.
- NFAA nominates up to 50 of the top ARTS awardees to a White House Commission for possible designation as Presidential Scholars in the Arts, part of the national Presidential Scholars awards program that honors academically and artistically talented high school seniors. Arts nominees go though the same evaluation process as other Presidential Scholars applicants: completing forms, sending transcripts, and writing compositions. Ultimately, about 20 young artists are chosen to be honored in June along with about 100 other Presidential Scholars at a week-long series of special events in Washington, D.C.

Deadline: The early deadline for ARTS applications is June 1, with a $25 application fee. Between then and the final application deadline of October 1, the fee increases to $35. Need-based fee waivers are available.

You may request an ARTS application from your high school principal or guidance counselor, or from ARTS, 300 NE 2nd Avenue, Miami, FL 33132; (305) 237-3416.

ARTS is administered for NFAA by Miami-Dade Community College, Wolfson Campus. The mission of NFAA is to encourage young artists in all art forms by assisting them financially and by creating opportunities for them to further their education and advance their professional careers. For information about other NFAA programs: NFAA National Headquarters, 3915 Biscayne Boulevard, Miami, FL 33137; (305) 573-4870.



Interlochen and Tanglewood are names that come quickly to mind when precollege arts programs are mentioned. Here, two of our readers enthusiastically describe what they have gained from these summer experiences.

INTERLOCHEN ARTS CAMP

by Derek Miller

Have you ever hummed along to Beethoven's *Ninth Symphony,* or recited Shakespeare along with Kenneth Branagh's *Henry V?* Or obtained special tickets to an art exhibit, or even tried to learn the dance steps from *Singin' in the Rain?* Then I know where you should spend your summer: Interlochen Arts Camp, on a 1,200-acre campus between two lakes in the woods of northern Michigan.

Founded in 1928 by Dr. Joseph Maddy, Interlochen has grown to make a unique contribution not only in the arts, but also to the lives of hundreds of thousands of people from around the world.

Interlochen's goal is very simple: to get people to love and develop their skills in music, visual arts, dance, or theatre arts. In order to achieve this, Interlochen hires some of the best teachers in these fields to come and help students develop their talents. Interlochen also invites guest artists as visiting faculty, including such diverse performers as Victor Borge, Yo-Yo Ma, the Beach Boys, Indigo Girls, the Boston Pops, Ray Charles, Canadian Brass, and Bill Cosby. The total effect is a summer filled with fun and learning.

I have attended Interlochen as a theatre major (musical theatre is a separate division), so I study the dramatic arts during the summer session and then act in a stage production at the session's end. So far, I have played parts in two serious dramatic productions, *Pfeiffer's People* and *The Rise and Rise of Daniel Rocket.* When I move into the high school division of Interlochen, I will be eligible to act in the Shakespeare play that is performed each year.

I first learned about Interlochen through a former teacher. It was perfect timing: I had taken advantage of most of the dramatic options at my school and was anxious for a summer-long theatre experience. Little did I know how much I would learn at Interlochen, how it would propel my interests in theatre and music to new levels.

Of course, the core of the life-changing Interlochen experience is its arts programming: classes and the contributions of visiting performers. But another important ingredient is the friendships that form during the summer. It's always special to find a friend who shares your interests. And at Interlochen thousands of students, teachers, and counselors are just as excited about the arts as you are.

These benefits can't be measured. For example, it was a new Interlochen friend who first introduced me to my two currently favorite pieces of music: piano concerti by Schumann and Mozart.

To give you a better feel for what Interlochen is like, I will tell you about a typical day. At 6:45 a.m. in Intermediate Boys (one of eight camp divisions), the director plays reveille on the trombone. All cabins wake up and have three minutes before a whistle summons the whole division to line up on the tennis courts. After announcements, we get into our camp uniforms for breakfast.

Yes, uniforms. But they aren't that bad. For boys, a light blue collared shirt and dark blue corduroy pants or shorts, with a belt of a specific color; the same for girls, but knickers instead of pants, with socks of a specific color. (Yes, knickers.)

After breakfast, it's time for morning classes: three periods of 45 minutes each, with 15 minutes between classes. Most classes are one period long, but some major courses—such as orchestra, band, and dance—may be two. Then lunch, followed by rest hour for divisions below High School. After that, two periods of afternoon classes, rec time, dinner, and possibly a concert in the evening. Taps are played at 10:00 p.m. And believe me, after that day, falling asleep is easy.

This article doesn't begin to describe how fantastic a place Interlochen really is and the many ways it opens doors for aspiring artists. If you're interested in the arts, give Interlochen a try. You'll love it, I promise.

***Derek Miller** is currently an 8th grader at Longfellow Middle School outside Washington, D.C. He has spent two summers at Interlochen and looks forward to returning for a third. Derek's summer major is theatre arts, but in his spare time, he plays the clarinet.*

INTERLOCHEN ARTS CAMP

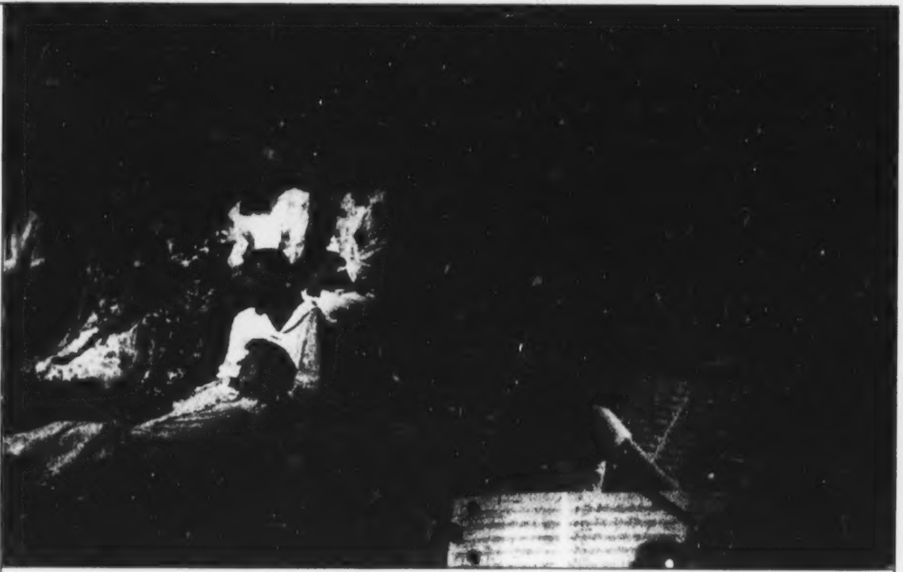
AGES 8-18, 8 WEEKS, WITH 4-WEEK OPTION FOR GRADES 3-6, RESIDENTIAL

Deadline: February 15; later if space is available.

Admissions Office, Interlochen Center for the Arts, P.O. Box 199, Interlochen, MI 49643-0199; (616) 276-7200; fax (616) 276-7860; e-mail: admissions@interlochen.k12.mi.us

BOSTON UNIVERSITY TANGLEWOOD INSTITUTE

by Jean Park



As someone who takes both academics and music very seriously, I have often had trouble deciding what to do with my summers. After attending two summer math programs, I wanted to try something new. This past summer, I spent eight weeks playing the violin in an intensive music program at the Boston University Tanglewood Institute in western Massachusetts. To say the least, it was a profound and rewarding experience.

In the beginning, the schedule seemed daunting. Our orchestra performed every two weeks, each time under the direction of a different guest conductor, so we had to master our parts quickly. In addition to an orchestra rehearsal every morning, we all studied chamber music in the afternoons. Evenings presented a host of opportunities. As the summer home of the Boston Symphony Orchestra, Tanglewood offers concerts by visiting artists and ensembles all the time. With our season passes, we could attend all the concerts and see world-renowned artists like Itzhak Perlman and Yo-Yo Ma performing.

Yet even with the abundance of activities available, some students still managed hours of individual practice each day. Out of inspiration and guilt, I was motivated to put in some time myself. After a while, playing the violin for such long hours didn't seem so strange.

With the high caliber of the students, a feeling of competition was always in the air. Although a competitive atmosphere is stimulating, it can also be unhealthy. Take seating arrangements, for example. Because evaluating music performance is so subjective, the ranking implied by seatings always seems to cause friction among some players, especially those used to being the best. The pressure to prove and maintain one's abilities is constant. Also, because many students are interested in pursuing careers in music, the ranking unfortunately becomes that much more important to them.

Despite all the seriousness, there was always time to relax and hang out with people. I spent many a night talking up a storm with a few friends about anything and everything. Not only was it great to have a shared interest in music, but the feeling of openness was so comfortable that we quickly became close friends. This sort of interaction definitely had a different twist from any I had experienced before.

The overall level of seriousness and dedication about music was very high. I remember talking with friends about our plans for senior year. Some were hoping to attend top music colleges like Juilliard and Curtis, and they intended to take just enough classes to fulfill minimum graduation requirements so that they could practice eight hours a day on their own! Even the many students who did not plan to continue professionally still had the passion that had driven them to achieve musically.

Being around so many motivated students presented a refreshing challenge. Although I had always thought of myself as a fairly accomplished violinist, I was never too sure of my abilities. Playing the violin was more like a hobby; pursuing music professionally was something that had never occurred to me.

At Tanglewood, seeing such highly dedicated people my own age pushed me to work harder than I ever had before. When I eventually became concertmaster, I realized how far I had come. For a while, I was consumed with the possibility of going on to a music school. Even though a serious search inward resulted in my decision not to do so, I know I will always cherish music and my memories of Tanglewood.

Music is potent. You can only understand its full power if you immerse yourself in it. The benefits of attending Tanglewood or any other music program can be immense. If you enjoy music and have the determination, then I would encourage you to jump right in. The water's warm. ■

*In addition to her violin studies, **Jean Park** enjoys "all sorts of things." As a senior in high school, she is involved in many activities including math and science competitions, yearbook, and tutoring. Jean would be pleased to answer questions about Tanglewood for **Imagine** readers; you may reach her via e-mail: JPARK@stu.ci.lexington.ma.us*

BOSTON UNIVERSITY TANGLEWOOD INSTITUTE

Ages 14–18, 2- to 8-week sessions emphasizing music, residential.

Deadline: March 15

Boston University Tanglewood Institute, 855 Commonwealth Avenue, Boston, MA 02215, (617) 353-3386.

MORE Summer PROGRAMS in the Arts

For additional suggestions, talk to your music teachers and refer to the books on page 13.

Note: When grades are listed, they refer to students' current, age-appropriate grade level.

American Academy of Dramatic Arts Summer Program, New York City and Pasadena, California

AGES 14 AND OLDER, COMMUTER ONLY

Six-week session in dramatic arts: acting, voice and speech, singing and movement. Also offered at New York only: dance (jazz), mime, theater/drama.

Deadline: Rolling admission

Director of Admissions, American Academy of Dramatic Arts, 120 Madison Avenue, New York, NY 10016; (212) 686-9244

or

Director of Admissions, AADA/West, 2550 Paloma Street, Pasadena, CA 91107; (818) 798-0777.

Boston University Theatre Institute

AGES 15 AND OLDER, RESIDENTIAL AND COMMUTER

Six-week session emphasizing theater, vocal music, and creative writing.

Deadline: May 20

Boston University Theater Institute, Boston University, 855 Commonwealth Ave. #470, Boston, MA 02215; (617) 353-3390

Carnegie Mellon University Pre-College Program in the Fine Arts

AGES 15-17, RESIDENTIAL AND COMMUTER

Six-week session in theater, dance, music, TV/video, visual and graphic arts.

Deadline: in May

Director of Summer Studies, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA 15213; (412) 268-7838.

Eastman School of Music, University of Rochester: Jazz Study or Music Horizons

AGES 15-18, RESIDENTIAL AND COMMUTER

One four-week session in Jazz Study or Music Horizons includes private instruction, theory, history, and performance. *(continued)*

Eastman School of Music at the University of Rochester: Summer Wind Ensemble

GRADES 9 & 10, RESIDENTIAL AND COMMUTER

One-week sessions; music history, performance with guest conductor.

Deadline: May 1

Director, Community Education Division, Eastman School of Music, Rochester, NY 14604; (716) 274-1400.

Harvard's Career Discovery Program in Architecture, Landscape Architecture, and Urban Design

AGES 16 AND OLDER, RESIDENTIAL AND COMMUTER

Forty-day session emphasizing career exploration in design.

Deadline: Rolling admission

Office of Student Services, Harvard University Graduate School of Design, 48 Quincy Street, Cambridge, MA 02138; (617) 495-5453.

Institute for Television, Film, and Radio Production at Boston University

AGES 15-18, RESIDENTIAL AND COMMUTER

Five-week program in film, radio broadcasting, television/video.

Deadline: Rolling admission

Institute for Television, Film, and Radio Production, Boston University, College of Communication, 640 Commonwealth Avenue, Boston, MA 02215; (617) 353-5015.

Maine College of Art Precollege Program

GRADES 10-12, RESIDENTIAL AND COMMUTER, LIMITED TO 30 STUDENTS

One four-week session in visual arts, design, and art history.

Deadline: June 7 ($100 discount if by May 10)

Maine College of Art Precollege Program, 97 Spring Street, Portland, ME 04101; (207) 775-3052 or (800) 639-4808.

Maryland Institute, College of Art: Pre-College Studio Residency Program

GRADES 10 & 11, RESIDENTIAL AND COMMUTER

One four-week session in studio figure drawing and sculpting; personal narrative in painting, photography, architecture, illustration.

Deadline: end of May

Maryland Institute, College of Art, Continuing Studies Office, 1300 Mount Royal Avenue, Baltimore, MD 21217; (410) 225-2365.

Minneapolis College of Art and Design: Summer Expression Session

GRADES 10-12, RESIDENTIAL

One two-week program combining drawing, painting, animation, movies, and video.

Deadline: May 15

Admissions Office, Minneapolis College of Art and Design, 2501 Stevens Avenue South, Minneapolis, MN 55404; (612) 874-3760 or (800) 874-6223.

New York University Tisch School of the Arts Summer Drama Program

GRADES 10 & 11, RESIDENTIAL ONLY, LIMITED TO 16 STUDENTS

One four-week session in the dramatic arts: Lee Strasberg Theatre Institute or Musical Theatre Program.

Deadline: April 1

Tisch School of the Arts Summer Drama Program, 12th Floor, 721 Broadway, New York, NY 10003; (212) 998-1811.

North Carolina School of the Arts Summer Session

AGES 14 AND OLDER, RESIDENTIAL AND COMMUTER

Five-week session in dance, music, drama, film-making, and visual arts.

Deadline: June 1

Office of Summer Session, North Carolina School of the Arts, P.O. Box 12189, 200 Waughtown Street, Winston-Salem, NC 27107; (919) 770-3204.

Parsons School of Design Summer Program, New York and Paris

GRADES 10 & 11, RESIDENTIAL AND COMMUTER

Five weeks in New York City or four weeks in Paris; design, architecture, photography, and painting.

Deadline: April 1

Office of Summer Programs/Continuing Education, Parsons School of Design, 66 Fifth Avenue, New York, NY 10011; (212) 229-8910.

Pratt Institute Summer Pre-College Program, Brooklyn and Soho/Manhattan

GRADES 10-12, RESIDENTIAL AND COMMUTER

One four-week session with multiple options in art, design, and architecture.

Deadline: June 1

Pratt Institute Summer Pre-College Program, School of Professional Studies, 200 Willoughby Avenue, Brooklyn, NY 11205; (718) 636-3453 or (212) 941-6397.

Rhode Island School of Design

GRADES 10 & 11, RESIDENTIAL AND COMMUTER

Six-week session in visual arts, including architectural design, fashion, and sculpture.

Deadline: May 31

Continuing Education Office, Rhode Island School of Design, 2 College Street, Providence, RI 02903-2787; (401) 454-6200.

The University of the Arts Pre-College Summer Institute

AGES 15-18, RESIDENTIAL AND COMMUTER

Two-, three-, four-, and six-week sessions in the media arts/writing, musical theater, visual arts, jazz performance.

Deadline: end of May

Pre-College Programs Office, The University of the Arts, 320 South Broad Street, Philadelphia, PA 19102; (215) 875-3355.

University of Oregon: Summer Architecture Academy

GRADES 10 & 11, RESIDENTIAL AND COMMUTER

Six-week session in environmental and architectural design.

Deadline: end of May

Department of Landscape Architecture, University of Oregon, Eugene, OR 97403-5234; (503) 346-3634.

University of Oregon: Summer Music Institute

GRADES 7-11, RESIDENTIAL AND COMMUTER

Five one-week sessions in piano, string chamber music, band, drum major, and jazz improvisation.

Deadline: String chamber, April 29; all others, June 15

School of Music, University of Oregon, Eugene, OR 97403-1225; (503) 346-5668.

Academic Summer Programs: Their Infinite VARIETY & Multiple Rewards

by Hubert Chen

As the cold, unfriendly winds of winter blow, summer may seem no more than a distant possibility. But in not much more time than is required for an eye to blink, summer will have arrived, reconfirming age-old proverbs. In fact, it's not too early to start making your summer plans *now.*

I've been hooked on academic summer programs since attending the Summer Institute for the Gifted (SIG) at the George School following my eighth grade year. In later summers, I returned to the George School once and also attended the Center for Talented Youth (CTY), the Pennsylvania Governor's School for the Arts (PGSA), and the International Summer Science Institute held at the Weizmann Institute of Science in Israel. Every one of these experiences was without parallel. For many reasons, I genuinely value the time I spent in each and want to encourage others to consider such programs.

Something for Everyone

Academic summer programs come in many shapes and forms. Some are dedicated to specific areas such as mathematics or music; others are academically oriented in general. Content and length also vary: During three weeks at SIG, for example, each participant takes four courses, attending each one for a block of time each day. At CTY, also three weeks per session, the entire time is spent studying one subject. At the five-week Weizmann program, we focused on science research for three weeks and traveled on weekends and during the other two weeks.

All the programs I chose were residential, but some offer the option of commuting or are for commuters only. Summer programs also vary regarding their daily schedules, rules about going off campus, curfew, parental visitation time, weekend options, college or high school credit, application process (many programs need only written applications, although PGSA required a live audition and Weizmann required an interview), tuition (PGSA and Weizmann were both free!).

Academic Rewards

One aspect of summer programs that attracted me was the opportunity to learn or experience something not offered in a standard curriculum. I discovered that studying a subject or engaging in some other activity outside the sometimes-contrived world of school gave me a better, more authentic perspective on what that subject entailed. For example, at PGSA I studied music theory, improvisation, jazz theory, composition, electronic music, piano, and sculpture.

Another plus I found is that the instruction at academic summer programs is of the highest quality. Typically, the instructors are extremely enthusiastic, are familiar with how gifted children learn and think, and are able to teach in a truly useful and invigorating manner.

Interpersonal Bonuses

Meeting people of the same age with whom you share the same passions—academic and otherwise—can be another satisfying and special aspect of summer programs. In fact, the peer interaction and social experience are at least as significant as the academic component, largely because of the types of people such programs attract.

Most of the students I met were there because they were truly interested in learning and wanted to learn, not because it was mandatory for them to be there. When students share such motivation, often much else is shared, which makes it easy to converse into the wee hours of the night and form friendships. I discovered I could hold engaging and insightful conversations with my peers—a genuine delight—and found myself challenging beliefs, just as my beliefs were challenged. I still keep in touch with many great friends I made at summer programs.

Assuming you are attending a program where few or no people know you, you will be judged not on past events or preconceptions, but on who you are now, on what you think and believe, rather than on anything

continued from previous page

else. This is a unique experience, one that can bring you to a new realm of self-awareness and can encourage your true identity to spill out.

Typically, your fellow students also share a passion for what you're studying, which can make a difference in your own attitude toward the subject matter. Before attending PGSA, I hadn't had many friends who shared my passion for music; as a result, I had regarded music as something associated primarily with adults and less accessible to people of my own age. But during and after PGSA, I found myself more interested in music and in learning new music than I had ever been before.

Yet another benefit of the social interaction at summer programs is that you may gain new perspectives on various types of people. Because some summer programs are selective and/or draw from a national or even international applicant pool, it's possible that you will meet people unlike any you have ever met before: people with extreme talent in one area, people with unusual mixes of talents or interests, people with uncommon combinations of characteristics. This environment can lead you to see past stereotypes and generalizations about others that may exist in your mind or in your hometown.

You may also gain a new perception about yourself. Many talented children grow up knowing that they are the best or among the top few in their local communities, academically and/or in other capacities. Then they experience shock when they enter college and discover hordes of people just as talented or even more talented than they are. It's important to realize that there will always be somebody who does anything you do well better than you do, that you will not always be the very best or even among the best. Realizing this early on can help you keep things in perspective. Knowing and making friends with summer program students who are far more talented gives you a higher standard for comparison and aspiration.

A Look into the Future

Besides preparing you for the personal shock you may experience when entering college, residential summer programs can also give you a feel for college life in other ways. Having to do your own laundry might be the first thing that springs to mind when the notion of living away from home and parents is mentioned. But living independently at a summer program involves much more.

Learning to live with a roommate and forming good time- and sleep-management habits are among the skills you can develop at summer programs—skills that I've found to be extremely important in college. And since most summer programs are held on college campuses, you're getting some sense of what college residential living is like.

Finally, the intellectual stimulation of summer programs can help you contemplate what you want to study in college and even what you want to do after college.

Lists, and More Lists

When deciding on a summer program, you'll want to consider many things besides your choice of academic subjects:

■ *How old are you? How much experience have you had living away from home?*

If this is your first time in a residential program, you might choose one that is relatively short in length and/or is located close to home. For instance, the George School was conveniently within an hour's drive of my home and had parent visitation hours on weekends.

■ *What about cost?*

Some summer programs may seem prohibitively expensive, but many do offer scholarships. As I mentioned earlier, some organization-funded programs, such as the Weizmann, are free. The National Science Foundation subsidizes a number of math and science programs across the country. Some states, such as my own, sponsor governor's schools that offer free or low-cost courses.

■ *What's your purpose in attending a summer program?*

Taking courses for high school or college credit is always an option, but it might be more worthwhile to expand your horizons by trying new things: going to a program that focuses on a strong interest, traveling overseas, or studying a less traditional academic subject, for example.

I weighed these alternatives when I had the option of attending PGSA or a number of science-related programs after 11th grade. I chose PGSA because I knew it was highly likely that I would go on to study science and might not have much chance in the future to immerse myself in the arts with "artsy people."

Another thing that made PGSA particularly appealing to me and preferable to other summer music programs was its emphasis on appreciating and understanding art in all its forms. Although all PGSA participants focus on a major (mine was music), they also spend a substantial amount of time studying a minor, another art area unrelated to their major (in my case, sculpture).

■ *Do you know enough about each program to make a good choice?*

It's wise to peruse all available program information while considering the different issues mentioned above. If you have questions, call the office. Talking to former participants is a good idea, too.

Go for It!

There are enough possibilities out there to satisfy the tastes of anyone, from the pianist to the budding mathematician. Acquiring information and completing applications to summer programs require a bit of initiative, but the payoffs can be enormous. And who knows? You might go to a program expecting to learn a lot about computer science or poetry, and end up learning just as much about people and life. ■

An undergraduate at Stanford, ***Hubert Chen*** *is gradually figuring life out. He aspires to pursue an interdisciplinary course of study. Hubie enjoys spending time interacting with music, writing, lying out in the California sun, sipping coffee over conversation, thinking, and watching "The Simpsons." Most people think he's headed for the Silicon Valley, but they're probably wrong. Hubie may be reached via e-mail: hubes@leland.stanford.edu*

1996

SELECTED ACADEMIC SUMMER PROGRAMS

For the past two years, our mid-winter issue has focused on academic summer programs, with course descriptions and student reviews. Rather than repeat that format, we include here only basic material about some of our favorite programs. Contact their staff for specific information about qualification requirements, course options, dates, fees, and scholarship availability.

Also, take a look at last year's January/February issue (Vol. 2, No. 3). If you don't have it, you may order a copy for $3.00 by calling the JHU Press: (800) 548-1784 or (410) 516-6989.

Note: Grades specified refer to students' current grade level. Space in many academic summer programs is limited, so apply early.

IAAY ACADEMIC SUMMER PROGRAMS

CAA New program!

Grade 7 participants in CTY Talent Search only, 3 weeks, residential sites in CA and MD.
Deadline: April 13
CAA/IAAY Summer Programs, The Johns Hopkins University, Baltimore, MD 21218; (410) 516-0277 or (818) 500-9034.

CTY

Grades 7-10, 3 weeks, residential and commuter sites in CA, MD, NY, and PA.
Deadline: April 8
CTY/IAAY Summer Programs, The Johns Hopkins University, Baltimore, MD 21218; (410) 516-0277; fax (410) 516-0804; web: http://www.jhu.edu/-gifted/cty.html

CTY Young Students

Grades 2-6, 3 weeks, commuter sites in MD and VA.
Grades 5 & 6, 3 weeks, residential sites in CA, CT, and MD.
Postmark deadline: April 13
CTY/IAAY Young Students Summer Programs, The Johns Hopkins University, Baltimore, MD 21218; (410) 516-0277; fax (410) 516-0200.

OTHER REGIONAL TALENT SEARCH PROGRAMS

CTD

Grades 5-12, 3 weeks, residential and commuter.
Deadline: May 15
Dr. Mark DeLong, Director, Center for Talent Development, Northwestern University, 617 Dartmouth Place, Evanston, IL 60208; (708) 491-3782; fax (708) 467-4283; web: http://ctdnet.acns.nwu.edu/mark/ctdinfo.html

Duke TIP (See Science and Study Abroad.)

Grades 7-10, 3 weeks, residential.
Deadline: May 1
Terri Williams, Admissions Officer, Duke University Talent Identification Program, Box 90747, Durham, NC 27708-0747; (919) 684-3847; fax (919) 681-7921; e-mail: terri@tip.duke.edu

Rocky Mountain Summer Institute

Ages 10-15, 2 weeks, commuter. Ages 12-16, 3 weeks, residential and commuter.
Deadline: May 20
Rich Radcliffe, Director, Rocky Mountain Talent Search, University of Denver, Wesley Hall-Room 203, 2135 East Wesley Avenue, Denver, CO 80208; (303) 871-2983; fax (303) 871-3422.

OTHER TALENT SEARCH-TYPE PROGRAMS

ADVANCE Program for Young Scholars

Grades 7-11, 3 weeks, residential.
Deadline: May 15
Leslie Ann Gregory, Assistant Director, Programs for the Gifted and Talented, Northwestern State University, P.O. Box 5671, Natchitoches, LA 71497; (800) 259-4438 (within state); (318) 357-4500; fax (318) 357-4547; e-mail: talbert@nsula.edu

ATS

Grades 6-9, 3 or 6 weeks, commuter.
Postmark deadline: April 29
Dr. Terry Thomas, Director, Academic Talent Search and Accelerated College Entrance Center, California State University–Sacramento, 6000 J Street, Sacramento, CA 95819-6098; (916) 278-7032; fax (916) 278-5930; e-mail: scarletm@csus.edu

Belin-Blank Center

Grades 3-6; 1, 2 or 3 weeks, commuter. Grades 6-9 (Junior Scholars Academy), 1 week, residential.
Deadline: Specific to each program.
The Connie Belin & Jacqueline N. Blank International Center for Gifted Education and Talent Development, The University of Iowa, 210 Lindquist Center, Iowa City, IA 52242; (319) 335-6148 or (800) 336-6463; fax (319) 335-5151.

CAP

Grades preK-11, 5 weeks, commuter.
Grade 5 & 6, 3 weeks, residential.
Grades 7-11, 5 weeks, residential.
Deadline: May 31
Dr. Barry Grant, Director, Center for Academic Precocity, Arizona State University, Box 872711, Tempe, AZ 85287-2711; (602) 965-4757; fax (602) 965-1069.

Carnegie Mellon C-MITES

Grades 3-6, 2 weeks, commuter.
Deadline: April 15
C-MITES, 4902 Forbes Avenue, Box 6261, Carnegie Mellon University, Pittsburgh, PA 15213; (412) 268-1629; fax (412) 268-8297.

Center for Gifted Studies

Grades 7-10, 3 weeks, residential.
Deadline: April 30
Dr. Frances A. Karnes, The Center for Gifted Studies, University of Southern Mississippi, Box 8207, Hattiesburg, MS 39406-8207; (601) 266-5236; fax (601) 266-4978.

OPPTAG

Grades 7-9 (Explorations!), 1 week.
Grades 7-10 (CY-TAG), 3 weeks.
Deadline: April 15.
Grades 10 & 11 (Iowa Scholars Academy), 3 weeks.
Deadline: April 1.
All residential.
Keith Davis, Program Coordinator, Office of Precollegiate Programs for Talented and Gifted, W172 Lagomarcino Hall, Iowa State University, Ames, IA 50011-3810; (515) 294-1772; fax (515) 294-6424; e-mail: opptag@ia.state.edu

Purdue Summer Residential Programs

Grades 4-6 (Comet), 1 week. Grades 6-8 (Star), & 9-12 (Pulsar; Nova—college credit), 2 weeks.
Deadline: May 31
Summer Residential Programs, Purdue University Gifted Education Resource Institute, 1446 LAEB, West Lafayette, IN 47907-1446; (317) 494-7243; fax (317) 494-4175.

SMU/TAG

Grades 7-9, grades 10 & 11 (College Experience), 3 weeks, residential and commuter.
Deadline: First come, first served.
Dr. Kathy Hargrove, Director, Gifted Institute and Precollege Programs, Southern Methodist University, P.O. Box 750383, Dallas, TX 75275-0383; (214) 768-5437; fax 214-768-3147; e-mail: khargrov@mail.smu.edu

Summer Stretch

Grades 5 & 6, 3 weeks. Grades 7-9, 5 weeks. Both commuter.
Deadline: First come, first served.
Halbert Robinson Center for the Study of Capable Youth, University of Washington, Box 351630, Seattle, WA 98195-1630; (206) 543-4160; e-mail: mosolf@u.washington.edu

VAMPY

Grades 7-10, 3 weeks, residential.
Deadline: First come, first served.
Dr. Julia Roberts, Summer Program for Verbally and Mathematically Precocious Youth, The Center for Gifted Studies, Western Kentucky University, One Big Red Way, Bowling Green, KY 42101-3576; (502) 745-6323; fax (502) 745-6279.

WCATY

Grades 5 & 6, 1 week. Grades 7-10, 3 weeks.
Grades 11 & 12, 3 weeks. All residential.
Deadline: April 26
Dr. Ellie Schatz (grades 7-10) or Deborah Katz Hunt (grades 5-6, 11-12), Wisconsin Center for Academically Talented Youth, 2909 Landmark Place, Madison, WI 53713; (608) 271-1617; fax (608) 271-8080.

HUMANITIES

Concordia Language Villages

Ages 7-18, 1, 2, or 4 weeks, residential.
Deadline: April 1
Concordia Language Villages, 901 South Eighth Street, Moorhead, MN 56562; (218) 299-4544, (800) 247-1044 (within state) or (800) 222-4750 (out of state); fax (218) 299-3807; e-mail: clvoffice@village.cord.edu; web: http://www.cord.edu

Foreign Language Institute

Grades 9-12, college credit, residential.
Foreign Language Institute, Simon's Rock College of Bard, 84 Alford Road, Great Barrington, MA 01230-9702; (413) 528-7227.

Junior Statesmen Summer School

Grades 9-11, 3 or 4 weeks, multiple residential sites in the U.S.
Deadline: May 1
The Junior Statesmen Foundation, 60 East Third Avenue, Suite 320, San Mateo, CA 94401; (800) 334-5353; fax (415) 347-7200.

National Journalism Scholars Academy

Grade 11 preferred, 4 weeks, residential site at the Peddie School, Hightstown, NJ.
Deadline: May 1
Lois Wolfe, National Federation of Press Women Headquarters Office, P.O. Box 99, Blue Springs, MO 64013; (816) 229-1666; fax (816) 229-1676.

Penn Summer Academy in Communication Studies

Grades 9-11, 3 weeks, residential.
Deadline: May 1
Eoghan Craig Ballard, College of General Studies, University of Pennsylvania, 3440 Market Street, Suite 100, Philadelphia, PA 19104-3335; (215) 898-5407; fax (215) 573-2053; e-mail: eballard@sas.upenn.edu

Summer Institute for the Gifted

Grades 4-11, 3 weeks, multiple residential sites.
Deadline: May 1
Dr. Philip W. Zipse, Summer Institute for the Gifted, College Gifted Programs, 120 Littleton Road, Suite 201, Parsippany, NJ 07054-1803; (201) 334-6991; fax (201) 334-9756.

MATHEMATICS

HCSSIM

Grades 9-11, 6 weeks, residential.
Deadline: Rolling admission
Dr. David C. Kelly, Director, Summer Studies in Mathematics, Hampshire College, Amherst, MA 01002; (413) 582-5375.

PROMYS*

Grades 9-11, 6 weeks, residential.
Applications accepted: March 1-June 1.
Professor Glenn Stevens, Director, PROMYS, Department of Mathematics, Boston University, 111 Cummington Street, Boston, MA 02215; (617) 353-2563; e-mail: promys@math.bu.edu

Rose-Hulman Young Scholars Program*

Grades 8-11, 4 weeks, residential.
Deadline: April 15
Dr. George Berzsenyi, Department of Mathematics, Box 121, Rose-Hulman Institute of Technology, Terre Haute, IN 47803; (812) 877-8474; fax (812) 877-3198; e-mail: george.berzsenyi@rose-hulman.edu

Ross Young Scholars Program*

Ages 14-17, 8 weeks, residential.
Deadline: May 15
Professor Arnold E. Ross, Department of Mathematics, The Ohio State University, 231 W. 18th Avenue, Columbus, OH 43210; (614) 292-1569; fax (614) 292-1479; e-mail: aer@math.ohio-state.edu

** NSF-sponsored programs. To learn about other subsidized science and math Young Scholars Programs, call the National Science Foundation: (703) 306-1616. (Note: Recent Federal furloughs have resulted in YSP processing delays.)*

SCIENCE

Brandeis Summer Odyssey & Odyssey Academy*

Grades 9-11, 4 weeks, residential.
Deadline: May 15
Marci McPhee, Brandeis Summer Odyssey, Rabb School, Mailstop 084, Brandeis University, P.O. Box 9110, Waltham, MA 02254-9110; (617) 736-2111; fax (617) 736-2111; e-mail: odyssey@logos.cc.brandeis.edu

Duke TIP Marine Labs

Grades 8-10, 3 weeks, Piver's Island, NC. Grades 7-10, 3 weeks, Texas A&M–Galveston, TX. Both residential.
Deadline: May 1
Terri Williams, Admissions Officer, Duke University Talent Identification Program, Box 90747, Durham, NC 27706-0747; (919) 684-3847; fax (919) 681-7921; e-mail: terri@tip.duke.edu

Duke TIP Scientific Field Studies

Grades 8-11, 3 weeks, residential sites in Costa Rica, CO, NM, and VA.
Deadline: April 15
Patrick Jordan or Palema Wallace, Duke University Talent Identification Program, Box 90747, Durham, NC 27708-0747; (919) 684-3847; fax (919) 681-7921; e-mail: patrick@tip.duke.edu OR palema@tip.duke.edu

Michigan State University High School Honors Science Program*

Grades 10 & 11, 7 weeks' research mentorship, residential.
Deadline: April 1
Dr. Gail Richmond, High School Honors Science Program, 330 Erickson Hall, Michigan State University, East Lansing, MI 48824-1034; (517) 355-1725.

** NSF-sponsored programs. To learn about other subsidized science and math Young Scholars Programs, call the National Science Foundation: (703) 306-1616. (Note: Recent Federal furloughs have resulted in YSP processing delays.)*

STUDY ABROAD

AATG Summer Travel-Study Trip to Germany

Ages 15-18, must have two years of German, 4 weeks, homestay.
Deadline: Students with qualifying AATG test scores will be notified.
German Testing & Awards Program, American Association of Teachers of German, 112 Haddontowne Ct. #104, Cherry Hill, NJ 08034; (609) 795-5553; fax (609) 795-9398.

CTYI, Dublin

Ages 12-16, 3 weeks, residential.
Deadline: April 18
The Irish Centre for Talented Youth, Dublin City University, Dublin 9, Ireland; 353-1-7045634; fax 353-1-7045693.

Duke TIP International Summer Study Trips

Grades 8-11, 3 weeks; China, England, France, Germany, Italy, and Japan.
Deadline: April 15
Patrick Jordan or Palema Wallace, Duke University Talent Identification Program, Box 90747, Durham, NC 27708-0747; (919) 684-3847; fax (919) 681-7921; e-mail: patrick@tip.duke.edu OR palema@tip.duke.edu

International Summer Science Institute

Grade 12 with independent research experience, 5 weeks, study and travel in Israel.
Deadline: March 1
Dr. Bessie F. Lawrence International Summer Science Institute, American Committee for the Weizmann Institute of Science, Suite 117, 51 Madison Avenue, New York, NY 10010; (212) 799-2500; fax (212) 779-3209.

OTHER RESOURCES

For additional possibilities, ask about precollege programs at your local colleges and universities, and consult these guides:

Computerized Database of Summer Programs for Gifted and Talented Students Sandra Berger, The Council for Exceptional Children, 1920 Association Drive, Reston, VA 22091; (703) 264-9471.

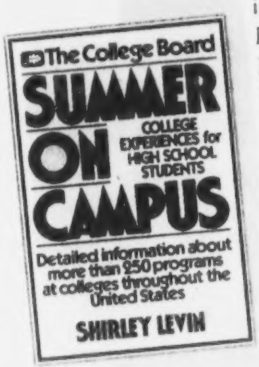
Directory of Science Training Programs for High Ability Precollege Students (1994, free) Available from Science Service, Inc., 1719 N Street, NW, Washington, DC 20036; (202) 785-2255.

Educational Opportunity Guide: A Directory of Programs for the Gifted (updated annually; $15.00) Duke University Talent Identification Program, P.O. Box 90747, Durham, NC 27708-0747; (919) 683-1400; fax (919) 681-1742.

Program Opportunities for Academically Talented Students (1995, $10.00) Publications & Resources, IAAY, The Johns Hopkins University, 3400 N. Charles Street, Baltimore, MD 21218; (410) 516-0116; fax (410) 516-0108.

SMART VACATIONS
COUNCIL ON INTERNATIONAL EDUCATIONAL EXCHANGE

Smart Vacations: The Traveler's Guide to Learning Adventures Abroad (Council on International Educational Exchange, 1993, $14.95) Available in bookstores or from St. Martin's Press, 175 Fifth Avenue, New York, NY 10010.


The College Board
SUMMER ON CAMPUS
COLLEGE EXPERIENCES for HIGH SCHOOL STUDENTS
Detailed information about more than 250 programs at colleges throughout the United States
SHIRLEY LEVIN

Summer on Campus: College Experiences for High School Seniors (1995, $15.00) Available in bookstores or from Department A40123, College Board Publications, Box 886, New York, NY 10101-0886.

Summer Opportunities for Kids and Teenagers (1996, $25.00) Available in bookstores or from Peterson's Guides, P.O. Box 2123, Princeton, NJ 08543-2123; (800) 338-3282.

Do special links exist between mathematics and music? A strikingly high number of mathematically talented students are also involved in the serious study of music.

Here two IAAY Senior Research Associates comment on possible links between the disciplines. Our first author holds a doctorate in educational psychology research, and the second specialized in neuroscience.

Music: A Bridge Between Two Worlds?

by Wayne Parker, Ph.D.

About thirty-five years ago, C.P. Snow made an influential speech entitled "Beyond the Two Cultures," later expanded into a book. Its thesis was that academia is divided into two worlds: the world of math and science, and the world of humanities and the arts. He pointed out that the two worlds have little contact, speak languages alien to each other, and view each other with suspicion and distrust. Snow considered it imperative that these two intellectual cultures—the scientists and the humanists—find a mechanism to bridge the gap between them.

Although Snow's thesis was popular, it ignored the long known—but little studied—relationship between mathematics and music.

Chopin, Bach, Schoenberg, Xenakis, and Cage all focused on math as a route to better their understanding of music. At the turn of the 17th century, the German astronomer Johannes Kepler attempted to explain the mathematics of planetary motion in terms of music; in the 18th century, Swiss mathematician Leonhard Euler studied music to improve his understanding of number theory.

What is the common ground between math and music? At first glance, we are more likely to be struck by their differences: music as emotion and math as logic. But the commonality may be that each is a language.

Music, math, Cobol, and Russian all have their own symbols, vocabulary, grammar, syntax, and structure. Music is expressed with dots and lines on a score, math and Cobol in symbols and equations, and Russian in a Cyrillic alphabet. None is intelligible to the untrained eye.

When we first learn a new spoken language, we have to translate each word and diagram each sentence, making it difficult to carry on the simplest conversation. Becoming fluent enough to respond without effort requires repetitive drills to make the flow automatic.

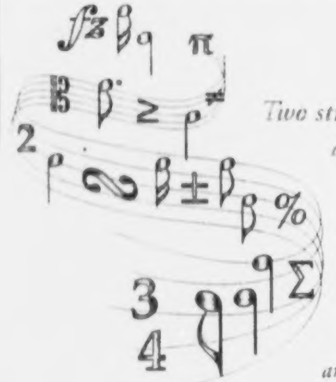
Likewise, if we have to stop and think, "Which note is C sharp?" or try to figure out which chord comes next, we cannot play music beautifully. If we don't know arithmetic facts or mathematical operations, it's virtually impossible to perform or understand mathematics.

All these activities require rote learning. Only when the basics become second nature can we become proficient. In effect, we must stop thinking before we can progress to a higher level where abstraction and interpretation are even possible.

The ability to comprehend one foreign language facilitates learning another. For example, a native English speaker who has learned French will then find it easier to pick up a third language. This is especially true if the third language is related to the second, such as Spanish or Italian; but even unrelated languages such as Japanese or Russian will also be easier to learn.

To address the question of whether or not learning a language such as music facilitates learning another language such as math, the Johns Hopkins IAAY/CTY Research Department is currently engaged in cooperative research with the Hopkins music program at Peabody Academy. With the support of the Abell Foundation, Peabody Academy has been providing formal music training in the standard curriculum at a Baltimore City elementary school. This training is available to all students in the school, not just to those identified as musically talented. We are investigating whether students in this stimulating program of formal music education will show higher levels of achievement in mathematics when compared with students in similar inner city schools without such a music curriculum.

Our expectation is that they will. And if we're right, this research may teach us a crucial lesson. In a time of national concern over shrinking education budgets, music education is often one of the first programs to be eliminated. But music education, rather than being an expendable frill, may be the bridge between Snow's two worlds—and an essential ingredient in a rigorous academic program. ■



Two students, both accomplished mathematicians and musicians, reflect on their own experiences of the relationship between math and music:

"Music and math are very similar in ways you might not expect. They're both about art and beauty, and about solid crafismanship. Care and joy go into designing an aesthetically pleasing proof, just as ingenuity and knowledge of how pieces fit together in a rather rigidly structured way go into designing a harmonically sound chorale phrase. Certainly, playing a musical instrument helps develop discipline and pride in a job well done. And that helps in all areas of academics—in life in general, for that matter."

—Charlene Ahn, *Harvard-Radcliffe College*

"For me, the relationship lies in the fact that both begin with logic. Arithmetic and musical notation are both exact, logical sciences. Everything has to be in its place; everything has to add up. I revel in their orderliness: no matter how complex a math problem or a measure of music seems, everything sorts out, everything lines up. Mathematicians and musicians combine numbers and notes to form more complex ideas. The beauty of music and math lies in the fact that the logical mind must combine with the creative mind to appreciate and understand these creations. They complement each other: similar thought processes are used to analyze and understand them, yet they produce distinctly different results."

—Carly Milner, *Dulles High School, Stafford, Texas*

Language, Music, Mathematics, and The Brain

by Carol Blackburn, Ph.D.

For millennia, philosophers, musicians, and mathematicians have speculated about how their respective realms of thought resemble and differ from each another. Today, those of us whose curiosity is piqued by such questions have the advantage of being able to consider neurological insights into the matter. How does the human brain process language? And how similar is that to the way in which it processes music? Or math? Considerable inroads have been made into understanding how the three-pound mass of soft tissue enclosed in our cranium processes language; how it allows us to experience music and mathematics remains more of a mystery.

The Two Worlds Revisited

In the realm of higher cognitive functions, we also encounter two worlds—not those of C.P. Snow, but rather, the right and left hemispheres of the cerebral cortex, evolutionarily the youngest part of the brain. The areas of expertise of the two hemispheres do not neatly partition into Snow's two worlds, despite efforts to characterize science as a left brain activity and art as a right brain activity. Instead, complex intellectual activities utilize processing strengths of both sides of the brain.

But right brain/left brain "explanations" have captured the imagination of our times. Readers are probably familiar with the notion that, for most right-handers[1], the left hemisphere is responsible for logical analyses, while the right hemisphere performs more holistic evaluations. Although the two hemispheres carry out some processing functions equally well, our highest cognitive activities are performed by specialized arrays that are *lateralized*, concentrated in one hemisphere or the other.

For most right-handers, the left hemisphere houses arrays that play the major role in analyzing information that can be appreciated symbolically. It is crucial in all our language- and symbol-based thought.

In contrast, the right hemisphere performs a variety of analyses that seem more subtle, more global. It provides a context that informs our interpretations. Two of its most important areas of expertise are emotional and spatial analysis: (a) interpreting the emotional content of stimuli such as facial expression, gestures, tone of voice; and (b) analyzing spatial relationships both in the world outside and the world of the mind. Right hemispheric activity generates a kind of understanding that is independent of words; we do not need words to comprehend our experiences in the emotional or spatial realms.

Lateralization and Learning

The use of our hemispheric resources is dynamic, strongly influenced by experience. The right hemisphere plays a more active role in processing novel stimuli, the left a more active role in analyzing stimuli that fit into already-familiar categories. Thus, in our first encounter with a new stimulus, the right hemisphere is preferentially activated; but once we can have enough experience with that stimulus to fit it into a category or logical system, many aspects of its analysis shift to the left hemisphere.

Such a shift occurs in language learning. We first hear another language as a stream of unintelligible sound, which activates the right hemisphere. Once we begin to perceive the sounds as words, aspects of their processing shift over to language modules in the left hemisphere. (Here we glimpse the neurological basis of why we cannot unlearn certain kinds of knowledge. Once we learn a language, it is impossible—short of brain damage to the left hemisphere—to return to hearing it as gibberish.)

Biologically Prepared Capacities

How is it that human brains are similar enough that we can make such generalizations about how they process complex information?

Scientists have come a long way from the notion of the brain as a *tabula rasa*, a blank slate upon which experience arbitrarily writes. Experts in a variety of cognitive domains—linguistics, neurology, psychology, and artificial intelligence—now concur that language and many other aspects of higher cognitive functioning are biologically "prepared" capacities in humans.

Just as other species are born with neural circuitry that enables them to learn species-specific behavior, the human brain comes equipped with the equivalent of pre-installed language-learning software. Exposure to appropriate stimuli at critical periods in our development[2] activates these processing modules, facilitating the acquisition of our own remarkable species-specific behaviors. (Here the software analogy breaks down, however, because our biological "software" changes as we learn, becoming ever more sophisticated and interconnected with other processing networks in the brain.)

MIT cognitive scientist Steven Pinker's fascinating book *The Language Instinct* reviews the evidence for this theory. Some of the most striking evidence for specific language-processing modules in the brain comes from studies of individuals who have suffered brain damage that has compromised their linguistic abilities. Such studies quickly lead us into a stranger-than-fiction world, in which a small brain lesion can damage the ability to *comprehend* written words without diminishing the ability to *write* words. Or destroy the ability to speak *verbs* but not *nouns* (imagine being able to say the noun "bark" but not the verb "bark"). Or disengage the ability to *speak* but not to *sing*.

The consequences of such brain lesions reveal that capacities that most of us take for granted as seamless—as we move smoothly and effortlessly from hearing linguistic information to decoding it to comprehending it in context—require the effective activity of a vast web of processing modules, each performing a crucial component of an enormous and complex task.

Lateralization and Language Processing

What have such studies revealed about the cognitive abilities of the two hemispheres? We look first at language, the higher cognitive function that has been studied most extensively.

For the majority of right-handers, the left hemisphere contains constellations of modules that give structure, order, and logic—syntax, semantics—to our language-bound world. Damage to one part of the left hemisphere can devastate a person's ability to comprehend written or spoken language, while damage to another can leave language comprehension intact but impair the ability to translate thought into communication, either through speech or writing.

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The right hemisphere plays the major role in understanding the emotional and contextual aspects of language. This includes the musicality of speech—the rise and fall of the voice, the change in dynamic emphasis—that is so important in conveying the full meaning of verbal communication. Someone with damage to the right hemisphere might be able to think and speak logically, but the delivery might be flat and emotionless. Or might be able to make logical inferences about a statement's meaning, but be unable to correctly interpret another's tone of voice, vocal inflection, or facial expression.

Lateralization and Mathematical Abilities

Less is known about the neurological bases of other higher cognitive functions. However, mathematical thinking, like language, also appears to arise from biologically prepared capacities. Crucial to nearly all mathematical thought are the left hemisphere's analytical and symbolic skills: the capacity for symbolic representation, for logical and abstract thought, and for carrying out complex sequences of mental operations. The right hemisphere's ability to comprehend spatial relationships and to reason spatially is also very important (clearly, more so in some areas of math than in others).

However, the neurological software that mediates mathematical thought appears to be more individualized than that of language. The evidence for this is that the linguistic deficits resulting from a given brain lesion are more predictable than are the mathematical deficits. Studies also indicate that at least some of the modules that mediate mathematical thought are distinct from similar linguistic modules: brain damage can affect one without affecting the other.

Lateralization and Musical Abilities

Neurologically, musical abilities appear to be even more individualized. This is not surprising when we consider the diverse range of skills related to musical ability—perception, analysis, appreciation, composition, performance—and how much individuals differ in their exposure to and experience with music. Harvard psychologist Howard Gardner has observed: "Perhaps most individuals learn in rather similar ways to speak and to draw; but the organization of music in the brain may differ dramatically depending on whether one has learned an instrument, what instrument one favors, whether one plays by ear, the extent to which one sings, and so on."

In the musically sophisticated, the left hemisphere mediates logical aspects of musical analysis, including reading and writing musical notation. Damage to the left hemisphere can leave musical imagination and appreciation intact, but impair the ability to translate musical thought into any meaningful form of communication. (Tragically, Maurice Ravel spent the last four years of his life still able to compose in his mind, but unable to communicate his creations.)

In the musically untrained, music is processed predominantly by the right hemisphere. Even in the musically sophisticated, emotional and spatial aspects of music appreciation are right hemisphere-based: appreciation of melodic and musical contour, of beauty of tonal quality, of spatial aspects of musical sound. For both the naive and the musically sophisticated listener, music can powerfully evoke the profound and transcendent impressions characteristic of activity in parts of the right hemisphere.

The neurological basis of musical ability, like that of mathematical abilities, appears to be considerably more individualized than that of language. Again, the musical deficits that result from a given brain lesion are less predictable than are the linguistic deficits. And again, the modular arrays that mediate some aspects of musical ability appear not to play an important role in linguistic or mathematical processing.

Aesthetic Experience

A central feature of musical experience, as well as of other higher cognitive processes, is the aesthetic pleasure it evokes. Although we may make broad generalizations about the *cognitive* aspects of musical processing, we are far from a neurological understanding of how music touches us *aesthetically*.

Manfred Clynes, physiologist and musician, has observed: "Practically nothing is understood about a central fact of musical meaning: how it comes about that a single phrase of music when performed by a great artist can move and transform the state of listeners, penetrate their defenses, and make them glad to be alive—while the performance of the same phrase by a lesser artist, only slightly different in form, does not have this power."

To reach such an understanding—even at its most basic level—will require a much greater knowledge of the complex relationships between the cortex and the underlying "emotional brain," the limbic system. The technical challenges of studying the activity of deeper brain structures, coupled with the difficulty inherent in studying something as complex and difficult to articulate as aesthetic experience, make this an area that will intrigue researchers for some time to come.

Good Exercise for Mental Modules

Even without knowing the neurological basis of aesthetic appreciation, we can value the great satisfaction that certain human endeavors bring. And whether music does or does not facilitate mathematical learning, both of these domains clearly allow us to develop parts of our brains that languish in predominantly linguistic activities.

Near the end of his book, Pinker speculates: "I would guess that most human 'cultural' practices . . . are clever technologies we have invented to exercise and stimulate mental modules that were originally designed for specific adaptive purposes." He suggests that exercising our mental modules—our inborn capacities—is inherently rewarding. Both mathematical and musical pursuits allow us to use parts of ourselves that may not otherwise find satisfying employment. We miss out on much pleasure and satisfaction—and leave many capacities lying fallow—if we don't give our non-linguistic modules a chance to play. ■

[1] This paper focuses on patterns seen in the 90-95% of right-handers who are left-hemisphere dominant for language and logic. Because left-handers comprise a minority of the population and are also more heterogeneous than right-handers in many aspects of hemispheric asymmetry, they have been less studied than right-handers.

[2] Most acquired abilities have a *critical period*—a developmental window of opportunity—during which acquisition, if it is to be optimal, must occur. For example, congenitally deaf individuals who do not learn sign language until they are adults never develop the linguistic proficiency or sophistication of those who learn to sign as children.

THE COACH'S CORNER

by Chengde Feng

Mr. Feng teaches mathematics at the Oklahoma School of Science and Mathematics (OSSM) and has coached many students who have competed successfully in mathematics contests in China and the U.S. In this column, Mr. Feng offers Imagine readers questions designed to improve their problem-solving skills.

SOLUTIONS TO THE MATH PROBLEMS FROM THE NOVEMBER/DECEMBER ISSUE.

1.

$$\sqrt{1+x^2} =$$

$$\sqrt{1+\frac{(1995^{\frac{1}{1996}}-1995^{\frac{1}{1996}})^2}{4}} = \sqrt{\frac{(1995^{\frac{1}{1996}}+1995^{\frac{1}{1996}})^2}{4}} = \frac{(1995^{\frac{1}{1996}}+1995^{\frac{1}{1996}})}{2}$$

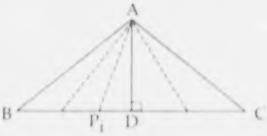
$$(x-\sqrt{1+x^2})^{1996} = (-1995^{\frac{-1}{1996}})^{1996} = \frac{1}{1995}$$

2.

$$\frac{1}{a}-\frac{1}{b}-\frac{1}{a+b}=0 \iff \frac{a+b}{a}-\frac{a+b}{b}-1=0 \iff \frac{b}{a}-\frac{a}{b}-1=0 \quad \text{Let } x=\frac{b}{a}\ (>0),\ x-\frac{1}{x}-1=0$$

$$\Longrightarrow x^2-x-1=0 \Longrightarrow x=\frac{1+\sqrt{5}}{2} \Longrightarrow x^3=2+\sqrt{5} \Longrightarrow \left(\frac{b}{a}\right)^3+\left(\frac{a}{b}\right)^3=x^3+\left(\frac{1}{x}\right)^3=2+\sqrt{5}+\frac{1}{2+\sqrt{5}}=2\sqrt{5}$$

3.



Let $\overline{AD}$ be the altitude, BD = DC = y, and $P_iD = X_i$ for i = 1, 2, . . . , 10.

$\Longrightarrow$ $BP_i \bullet CP_i = (y-x_i)(y+x_i) = y^2 - x_i^2$ for i = 1, 2, . . . , 10.

(If P_i is on $\overline{DC}$, then $BP_i = y + x_i$, and $CP_i = y - x_i$)

By the Pythagorean theorem, $AP_i^2 = AD^2 + x_i^2$

$\Longrightarrow$ $AP_i^2 + BP_i \bullet CP_i = AD^2 + y^2 = AC^2 = 4 \quad \Longrightarrow \quad \sum_{i=1}^{10} (AP_i^2 + BP_i \bullet CP_i) = 4 \bullet 10 = 40$

4.

(1) If $1 \le n \le 4$, then $[\frac{n^2}{5}]$ is prime when n = 4.

(2) If $n \ge 5$, then n = 5k + r, where k and r are both integers, $k \ge 1$, and $0 \le r \le 4$.

$$[\frac{n^2}{5}] = [\frac{(5k+r)^2}{5}] = [5k^2+2kr+\frac{r^2}{5}] = 5k^2+2kr+[\frac{r^2}{5}]$$

(a) If r = 0, 1, or 2, then $[\frac{r^2}{5}] = 0$. $[\frac{n^2}{5}] = 5k^2 + 2kr = k(5k+2r)$, and will be prime if and only if k = 1 and r = 0 (n = 5) or r = 1 (n = 6).

(b) If r = 3, then $[\frac{r^2}{5}] = 1$. $[\frac{n^2}{5}] = 5k^2 + 6k + 1 = (5k+1)(k+1)$, and is not a prime.

(c) If r = 4, then $[\frac{r^2}{5}] = 3$. $[\frac{n^2}{5}] = 5k^2 + 8k + 3 = (5k+3)(k+1)$, and is not a prime.

Therefore, the desired integers n are 4, 5, and 6, and their sum is 15.

5.

PROOF: Assume temporarily that f(x) = g(x) h(x), where g(x) and h(x) are linear factors with integer coefficients. Then f(1) = g(1) h(1), f(2) = g(2) h(2), f(3) = g(3) h(3), f(4) = g(4) h(4), and f(5) = g(5) h(5). Since f(1) is a prime, either g(1) or h(1) must be 1 or -1. Similarly, either g(2) or h(2), g(3) or h(3), g(4) or h(4), and g(5) or h(5) must be 1 or -1. Thus, five of the ten numbers, g(1), g(2), g(3), g(4), g(5), h(1), h(2), h(3), h(4), and h(5) must be 1 or -1. On the other hand, since g(x) is a linear factor with integer coefficients, at most two of g(1), g(2), g(3), g(4), and g(5) can be 1 or -1. (Why?) And at most two of h(1), h(2), h(3), h(4), and h(5) can be 1 or -1. Thus, at most four of the ten numbers, g(1), g(2), g(3), g(4), g(5), h(1), h(2), h(3), h(4), and h(5) can be 1 or -1. This contradicts the conclusion mentioned above that 5 of the ten numbers must be either 1 or -1. Therefore, f(x) cannot be factored into two linear factors with integer coefficients.

EXPLORING CAREER OPTIONS

by Marlene Aquino

Interview with Anne Altemus: Medical Illustrator

***Anne Altemus** is a medical illustrator in the Audiovisual Program and Development Branch at the Lister Hill National Center for Biomedical Communications, National Library of Medicine, National Institutes of Health. She also holds an appointment as a faculty lecturer in the Johns Hopkins Department of Art as Applied to Medicine.*

How did you first become interested in medical illustration (MI)?

I first heard about the field at a career day in high school. I was very interested in art, and I was also interested in science and had a strong academic background. I had only a cursory sense of what a medical illustrator (MIr) did—but I still decided that I wanted to be one because it seemed like such a logical combination of my two interests.

I also felt that MI would be a career in art that would pay me. It's a challenge for a young artist to find a paid position other than in graphic design, architecture, or interior design. MI is another employable kind of artistic expertise.

So from there . . .

I had a very liberal arts education in college, completing majors in sociology and fine arts and a minor in biology. After college, I applied to the Art as Applied to Medicine graduate program at Johns Hopkins. I had the academic background, but my art portfolio was clearly lacking in life drawing. So I spent the next four years working full time and going to school part time, strengthening my portfolio. It took me three years of reapplying to get into Hopkins, but I was never discouraged. They were always very encouraging, saying, "You need to work a little more on this, a little more on that."

Anne Altemus

Would you say that you had artistic talent?

Yes, I clearly had talent. However, it took me a long time to develop it to a point where my portfolio was accepted. But it was worth all the extra work. One particularly good class was Anatomy for Artists, a life drawing class taught by a terrific MIr. The pieces in my portfolio from that class clinched my acceptance into the Art as Applied to Medicine graduate program.

Could you outline Hopkins' two-year master's program?

The first year is basically fundamentals, learning techniques that MIrs employ: pen and ink (an aspect of illustration that is brilliantly taught at Hopkins), airbrush, and photography. Students also take many of the first-year medical school classes: Gross Anatomy, Molecules & Cells, Histology, and Pathology. There's also a very strong course in Anatomical Sketching; students sketch from life, dissect, and create anatomical images based on actual materials.

During the summer after the first year, students complete internships in a wide range of settings all across the country, from veterinary schools to some very high-end computer animation companies. It's almost like another class. You get to see a real life scenario and the different roles a MIr can play.

In the second year, students do a thesis: three and a half months of benchwork, research, writing, and illustrating. They gain further experience in using their skills not only to render lovely images, but also to generate images that are educationally effective.

There's also a multimedia class, in which students guide an entire project of their own choosing. We've had some huge successes in the past few years, with students generating some really nice projects.

So the MI programs are adjusting to developments in audiovisual technology?

Yes, they are. When I graduated just five years ago, I used a computer only for word processing. The students arriving now are so technically sophisticated that *they* teach the faculty about the new computer software. Three of this year's graduate students generated computer-aided instructional materials, and two utilized the computer in a very sophisticated fashion for their thesis projects. They are well-trained to meet the challenges of technology in this field.

It sounds as though you have a high regard for the Hopkins MI program.

I do, both as a student and now as a faculty member. Students arrive at the program with a measurable level of talent; they've worked on their art—they don't come to this program to learn how to do art. They also arrive with a basic background in medical science. But something happens in the two years. They cross over. They're taught techniques and methods to communicate accurately, and they learn to work with teams of researchers and scientists.

Did you come to the National Library of Medicine (NLM) straight after Hopkins?

Yes, I did. I've been here for four years, and it's fascinating work. The NLM's mission is to disseminate medical information to as many people as it can and to be a clearinghouse for databases. Traditionally, those databases have been texts and journals. I came here at a very exciting time, as the NLM was getting into digital technology.

Tell me more about the project you are currently working on.

Cardiac Embryology was actually the project that brought me to the NLM; I was brought on board as the illustrator. The idea was to build a series of 3-D models of the developing embryonic heart that students could interact with on the computer.

Currently, embryology is taught by lecture or books, using images and text. Like so much medical information, embryology is most effectively communicated visually. Two-dimensional images are nice, but each image can show only one moment in time; in embryology, something happens every second.

So we're attempting to build 3-D models of a period in embryogenesis and to make those models available interactively. The computer allows us the privilege of what we call animation—showing development in sequence over time. In a way, it's like recreating life. This is an ambitious project, and we've reached the limits of the current technology, so we're having a hard time fulfilling our original vision.

This would be an ideal educational tool for medical students.

Exactly. Furthermore, it will be helpful not only in the training of medical students, surgical residents, and anatomists, but also in *patient* education—to help patients understand the normal development of the heart so they can understand what may have gone awry in the anomaly they have.

It sounds as though embryology and developmental biology have become your specialty.

It certainly has evolved that way. I must say that I really have a penchant for developmental biology; I've always been excited about it. I'm fortunate to have secured a job that allows me to explore that area very thoroughly.

Is most of your time at the NLM spent on the Cardiac Embryology project?

I work on several different teams. On some teams, I contribute the visuals; on others, the creative ideas for video and multimedia projects. I'm also the project supervisor for Cardiac Embryology, in charge of organizing the teams, doing research, and generating the final product. At this point, I do a lot of coordinating.

Do you enjoy that aspect of your work?

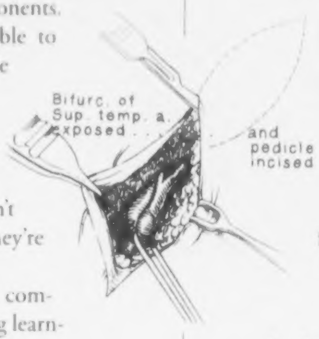
Yes, I do. I was surprised. I never expected that I would be in that role. However, my training as a MIr is key to my success in coordinating these projects. What I'm doing is organizing visual assets for audiovisual projects, whether videos, CD-ROMs, or interactive CDs.

I'm also continually learning new technological skills, and how technology plays into medical education—which applies not only to medical students but also to continuing education in all the allied health fields, where professionals must constantly keep abreast of new information.

How would you describe the challenges of being a MIr?

The primary challenge is that of creating a visual product that successfully communicates an idea to an audience. To illustrate medicine and science, you have to understand it, so this challenge has both scientific and artistic components.

You also have to be able to communicate with people because you work with clients and with other illustrators. There are some outstanding illustrators out there who can't hold a conversation. They're not particularly popular.



Finally, you have to be committed to a career of lifelong learning. Both your subject matter—medicine and science—and your tools—technology—are always evolving. In training MIrs, we try to impress upon them: "You're going to spend the rest of your life learning. We hope you'll enjoy it."

It sounds as though audiovisual technology is having an enormous impact on MI. Do you ever have a hard time keeping up?

Yes! But it's not impossible. And, in any case, it's mandatory. New A/V technologies are the most challenging tools that have ever been presented to the field, allowing us to do new and fascinating things; but you still need an illustrator to translate data into something successful and understandable.

Angle of incision
parallels hair
follicle
1
2

Have you been surprised by anything about your work as a MIr?

I suppose the thing that has surprised me the most is how much I have come to love medicine. Some future MIrs have the privilege of loving biology in their undergraduate years or when they first arrive in the MI program. I have to say that I leaned more toward the artistic end of things. Now my outside activities may include anything from going to a medical symposium to going to an art museum. My work is a wonderful marriage of two interests, and my left brain and right brain dialogue all the time.

Do you find time to balance your career and your personal life?

I don't have a family yet, but there is certainly room for that in my life. I know several MIrs who balance the many aspects of their life very well. From that point of view, MI is a good, flexible career; it's not hard to have both a private life and a working life. If I were to begin a family, I could keep my job or free-lance, giving me some flexibility to work outside or from my house. It's a very fulfilling career, I have to say.

What are your thoughts on the future of the field?

It's a very exciting time, more exciting now than it has been in the past 10 to 20 years. (Of course, I wasn't around 10 or 20 years ago—back then, they may have been equally as excited as I am now.) Because of developments in technology, we're now presented with so many new opportunities, new niches.

Across the country, there are more and more requests for MIrs—to provide visuals and to help steer groups to generate products (CD-ROMs, videos, animation) that are both well thought out and educational. Technology has given us brand new tools to work with, so we are very well equipped to do some wonderfully fascinating things. ■

Following her graduation from The Johns Hopkins University, ***Marlene Aquino*** *worked for IAAY's Academic Programs and Study of Exceptional Talent. She returned to school last fall to pursue a career as a medical illustrator.*

FASCINATING CLASSICS

THE MAYOR OF CASTERBRIDGE

by Thomas Hardy

Review by Lesley Mackay & Carol Blackburn

Lesley: And I thought *Middlemarch* got off to a shocking start! George Eliot's depiction of an unpromising marriage was surprising, but the first pages of *The Mayor of Casterbridge* made my jaw drop. Our first long look at Thomas Hardy's protagonist, Michael Henchard, shows him drinking at a roadside fair, a wife and infant daughter at his side. Alcohol aggravates Henchard's resentment that he must support a family. In a fit of rage, he sells both his wife and daughter to a stranger.

Carol: This scene does make quite a first impression! Hardy pulls no punches in opening his dark character study with an act that, even in the novel's bleak social world, is deemed appalling and reprehensible. Other breadwinners may have moments when they too experience their dependants as burdensome, but not many jettison their dependants so callously and ignobly.

Lesley: Hardy has already warned us that he will be dropping us down in a grim milieu. He first shows us Henchard, a laborer, and his careworn young wife as they trudge lifelessly down a road. The woman's face shows "the hard, half-apathetic expression of one who deems anything possible at the hands of Time and Chance except, perhaps, fair play."

Carol: I found it hard to believe that this novel and *Middlemarch* were set in roughly the same part of England, so different are the emotional and even physical climates of the two books. Despite the difficulties Eliot's characters face, their world seems basically sunlit. Eliot's essentially compassionate view of human nature illuminates her characters and their world with a warm and generous-spirited light.

In *The Mayor of Casterbridge*, in contrast, it seems as though the sun never shines. Hardy's bleak view of life overshadows this novel, allowing few rays of light to break through the dense cloud cover. One character crystallizes this novel's dark perspective when she muses that life is "a tragical rather than a comical thing; that though one could be gay on occasion, moments of gaiety were interludes, and no part of the actual drama."

Lesley: Why are we recommending a novel to our readers that is fundamentally bleak? Because Hardy does a compelling job of portraying a basic dimension of human existence: the dimension concerned with survival.

The Mayor of Casterbridge is about people who do not enjoy economic security. Hardy is interested in the characters and fates of those who live without a safety net, who fight against the elements for livelihood and even for life. What values guide such individuals? How do they relate to their community? How do they react when they succeed—and when they fail? These are some of the questions entertained in this novel.

Carol: Yes, in *Middlemarch*, despite the financial concerns that weigh heavily on many characters, none is so poor or devoid of family resources as ever to face life on the streets. In this novel, however, survival is a real issue and destitution an ongoing possibility. It is within the context of this elemental struggle that Hardy's characters live their lives.

Lesley: Hardy brings a great deal of suspense to his depiction of his characters' struggles. *The Mayor of Casterbridge* is full of plot twists that are actually hairpin curves. The novel derives much of its energy from unexpected reversals of fortune and fate.

An early reversal basic to Hardy's plot is the remarkable progress Henchard makes during the nearly two decades following his terrible moral crime, his selling of his family. After that early scene, Hardy leaps over eighteen years, resuming his tale when Henchard is middle-aged. In those intervening years, Henchard has become a respected figure in his community, and in fact, as the book's title indicates, he holds the mayorship of his small town.

Carol: Initially, I felt respect for the older Henchard, who seems to have learned from his terrible act. Realizing that he would never have done such a thing had he not been drunk, he swore off alcohol and has remained sober since. And he has worked long and hard, achieving success as a farmer with many townspeople in his employ.

Lesley: It takes us a while to appreciate that, while Henchard has had the self-discipline and sheer will to turn his life around, he really hasn't changed all that much. He is still the same person inside: rough and temperamental, jealous and resentful, with an almost primitive lack of self-awareness. Hardy vividly characterizes him as "a vehement gloomy being who had quitted the ways of vulgar men, without light to guide him on a better way."

Carol: Sometimes he does seem able to feel genuine concern or affection for others; but when his mood sours, he sees other people as adversaries. This tendency is not helped by his habit of attributing his bad moods to the actions of other people; his lack of self-awareness concerning his moods is almost comical. When he awakens after having sold his wife, he is annoyed, and he admits that part of his annoyance is with himself. But he is also furious with his wife for doing something that she "should have known" would reflect badly on him: "'Seize her, why didn't she know better than to bring me into this disgrace?'" Henchard can be ingenious at casting the people around him as his enemies.

Lesley: I think that what you are getting at, Carol, is that this novel is primarily a character study. Like Joseph Conrad in *Lord Jim*, Hardy probes the psyche and soul of a troubled human being. But this novel is not as meditative or finely wrought as Conrad's modern psychological masterpiece. It has the same rawness as the visceral world it describes.

Carol: One advantage of that immediacy is that the novel does not seem moralistic. No narrator or interpreter stands between us and Henchard; Hardy lets Henchard's actions and their consequences speak for themselves.

However, despite the marked stylistic differences between the novels, there are many interesting similarities between Conrad's Jim and Hardy's Henchard. As young men, both commit ignoble acts, and both try to learn from those acts. But the novels allow us to see the characters' later lives, revealing that neither man gained the insight into himself that he needed to transcend his youthful character flaws.

Lesley: Hardy introduces other characters whose natures are more flexible than Henchard's. *The Mayor of Casterbridge* does speak to the possibility of lightness of spirit and of human refinement.

One character light in spirit is Donald Farfrae, the young Scotsman whom Henchard hires as his farm manager. Farfrae has such an easy charm and a quick mind that he soon eclipses his mentor both in business and in the social life of Casterbridge.

Carol: Hardy makes a vivid comparison between Farfrae's quickness of mind and Henchard's powerful passions as "Northern insight matched against Southern doggedness—the dirk against the cudgel." Farfrae's mind is sharp and incisive, his actions judicious. However, the comparison with a knife is somewhat misleading. Unlike Henchard, Farfrae is not dangerous; he does not want to use his powers against others. His mind is like a fine tool, not a weapon, and he relishes applying it to the challenges of life.

Lesley: I agree. Farfrae seems to transform Hardy's grim landscape simply by being in it. His greater enjoyment of challenge sets him apart from every other character in the book. He succeeds where others might fail in part because he possesses some detachment about his success and community standing. When we first encounter him, he openly informs Henchard of a method for salvaging corn harvested too late in the season. He freely gives away this valuable information; he is not interested in hoarding his ideas.

Carol: Another character who has a lighter and more refined quality is Lucetta Templeman, a financially independent young woman who moves to Casterbridge late in the novel. Lucetta, graceful and sophisticated, brings to Casterbridge a glimmer of a more civilized world. Her aura of refinement—and her financial security—exemplify a way of life that the local residents can only dream of.

Lesley: Lucetta provides an interesting comparison with the two major male characters in the novel. Although in her levity of spirit and grace she is like Farfrae, she actually has more in common with Henchard. Like him, she can be mercurial, manipulative, and obsessed with social position. I enjoyed watching the tightrope walk of her social climb, through which she seeks to establish herself as a refined and genteel woman in a town where her past is not known.

Carol: Her concern with social status is different from Henchard's, though, in that, as a single woman, she is much more vulnerable to public opinion. Despite her financial security, her life could be shattered if public opinion were to turn against her.

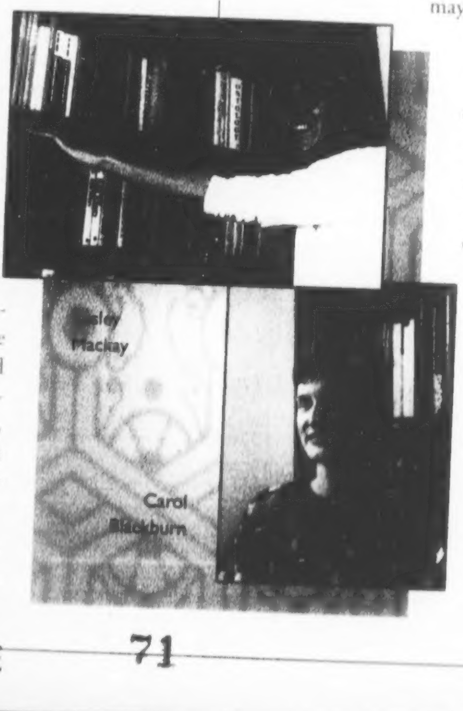
Lesley: Another vulnerable character who works towards greater refinement is Henchard's daughter, Elizabeth Jane. A rather unassuming young woman, Elizabeth Jane suffers much throughout the novel, often at the hands of the domineering Henchard. But she finds ways to transcend the limits and the suffering that life imposes upon her, learning "the secret of making limited opportunities endurable." She doggedly educates herself by reading. She also thinks seriously about ethics and tries to practice the principles in which she believes. To me, she seems like one of the "quiet heroines" George Eliot refers to in *Middlemarch*.

Carol: Elizabeth Jane's perseverance in trying to elevate her life is one of the glimmering lights in this novel. Her resourcefulness and strength in making the best of her opportunities provide a profound contrast to Henchard's disregard for all that he has.

We should not end without noting that, despite all we've said, Henchard is not an entirely unsympathetic character—and I think this is something of an accomplishment on Hardy's part. There is something heart-rending about him; his life doesn't have to be as painful as it is. But it takes him so long to realize that most of the pain he suffers is the result of his own actions. Henchard's life offers a potent negative illustration of the power one has to shape one's fate.

Lesley: Other, kinder variations on that theme play out in the fortunes of Farfrae, Lucetta, and Elizabeth Jane. Through the fates of these characters, the novel suggests that, even in difficult circumstances, moral excellence and hard work can be rewarded.

Carol: Young readers might wonder whether this novel, set in times and conditions so different from our own, has anything to say to us today. Given the psychological sophistication so many people now have, one might (wishfully!) imagine that no modern individual could have as little insight into his or her dark side as Henchard does. But history teaches us otherwise. Henchard's character and political trajectory mirror almost eerily the character and fortunes of a man who became not mayor but president: Richard Nixon. Hardy's novel may be set in a very different world from the one we now inhabit, but the truths he explores play a timeless role in the human drama. ■



Continuing our exploration of the dark side, the next novel to be reviewed in this series is Mary Shelley's *Frankenstein*.

Lesley Mackay, who holds a B.A. from the College of William and Mary and an M.A. in English from Indiana University, is IAAY's Staff Writer.

Carol Blackburn, who holds an M.A. in counseling psychology from Pacifica Graduate Institute and a Ph.D. in pharmacology from The Johns Hopkins University, is Senior Research Associate at IAAY's Study of Exceptional Talent.

STUDENTS REVIEW

UNIVERSITY OF CALIFORNIA AT BERKELEY

College Review Series

This on-going series is intended to aid prospective college students in their search by offering insiders' views of selected colleges and universities, as expressed by current undergraduates or recent graduates who have exceptionally high academic ability. Our reviewers all share high expectations for a college's academic standards and its nurturance of emerging talent.

Note that the number of student reviewers is small. Consider their personal perspectives as only one component while you gather factual information and impressions from such other sources as college catalogues, site visits, talks with officials and students on campus, and the advice of your guidance counselor and teachers.

UC–Berkeley

Our reviewers include eleven students, who major(ed) in biophysics & molecular cell biology (1), chemistry (1), computer science & electrical engineering (4), economics (1), interdisciplinary studies (1), math (3), and physics (1). (The number of majors exceeds eleven because one student has a double major.) Students' comments appear within quotation marks.

Quality of Academic Instruction for Undergraduates

All but one reviewer gave high marks to the quality of undergraduate instruction—by both faculty and graduate teaching assistants—and to the academic resources—facilities and libraries. Some aspects of undergraduate education, notably class size, have been affected by financial cutbacks; and several reviewers noted that, especially in the School of Engineering, restricted enrollment in upper-level courses can make it difficult to fulfill degree requirements in four years. However, all reviewers agreed that, if one makes the effort, Berkeley offers an excellent educational experience.

"Berkeley's education is first-rate. To get the most out of a Berkeley education takes some effort but is well worth your time. The professors are usually outstanding lecturers, both in terms of their instruction and in terms of their prowess in their field. I've found that many professors are willing to meet and develop relationships with students if you take the time and effort to do so. Teaching assistantships here are desirable, so many (but not all!) TAs are also excellent instructors. The most important aspect of a Berkeley education is that you get out of it what you put in; it takes effort on your part to get the superb education and experience that Berkeley has to offer."

"The quality of instructors for both graduate and undergraduate classes is top-notch. My freshman year, I had one Nobel laureate and the about-to-be-head of the Mathematics department. The professors are usually impossible to reach in large courses, but some are very receptive."

"The professors at Berkeley are world class, and the academic resources and opportunities are unrivaled. There is, certainly, a problem with student/professor ratios. The class sizes for lower level classes are sometimes ridiculous, running to over 1,000 students. The sizes of upper level courses are more reasonable, however, and there's a greater chance of meeting professors in those classes. Throughout your undergraduate years, the teachers you are most acquainted with are the TAs. All this is not to say that professors are inaccessible. In fact, the perception that they are inaccessible makes them often free during their office hours."

"The undergraduate lower division courses can certainly be ridiculously large (the General Chemistry course last fall had around 1,400 students), aggravated by budget cuts and consolidation of courses. But I've found that, if one is willing to follow a path less traveled, or reach for an Honors class whenever the choice arises, the enormous numbers evaporate. The best part is, of course, that the Honors classes are very good and make the switch worthwhile."

"Berkeley, being very large, has almost unlimited academic resources. However, I have been disappointed in the quality of instruction. To be sure, you get a good education at Berkeley, but the tenured faculty (in the sciences, at least) favor research over teaching. In these years of extremely tight budgets, undergraduate education is suffering the most."

"The atmosphere for freshmen and sophomores is very competitive and difficult, especially for technical majors. Courses are interesting and fast-paced. And in my opinion, required curriculum is essential, not excess baggage. I just wish they would budget better regarding faculty-to-student ratios in low-level courses."

"It can be very difficult to get into the classes that you want/need because so many have been impacted by financial cutbacks. This is especially an issue for students in the College of Engineering, who need to make every unit count in order to graduate in four years."

"Grading is difficult—the average grade is C+ or C; only 10-15% As—and you have to really work for those As."

"I wouldn't consider undergraduate education to be uniformly good or bad. Under the pressures of growing wait-lists and fewer courses, undergraduates must choose well the first time and learn to bear the occasional unbearable requirement."

Social Life

Berkeley's location, across the Bay from San Francisco and backing up to a nature and wildlife preserve in the Berkeley Hills, offers students easy access not only to the social life of a major university but also to the cultural offerings of a major city and scenic natural areas.

"The possibilities are infinite. An advantage to a large university is that there are more people to meet and more activities to join, and this is especially true of Berkeley. There are literally hundreds of clubs and thousands of activities. Berkeley is also a couple of miles away from regional parks that are extremely scenic—with great proximity to hiking, camping, rock climbing, skiing—so nature experiences are also very possible. As for parties, there is inevitably one every week."

"The Greek system is strong. While we avoid the Animal House image—people do come to Berkeley to study, too—one can have as active a social life as one wants."

"Dorm/frat life provides a vast array of people to meet and scheduled activities. Most social events are organized by individual dorms or frats; there are frequent frat and sorority, as well as co-op, parties. Just off-campus, there are cafes, good (and cheap) ethnic restaurants, and bars, as well as movie theaters and stores. There are many, many clubs based on almost any kind of interest (racial/ethnic, political, sexual orientation, outdoor activities, service, journalism, dance, music, etc.). It's up to each student to look for what interests him/her and seek out his/her own circle."

"Incoming students should perhaps be warned that Berkeley has a housing shortage—it can be a big problem. Try to get it settled early!"

"The political climate is . . . weird. But both liberals and conservatives have fun. The diversity and tolerance are wonderful."

"One cannot overstress the extracurricular and social opportunities in the San Francisco Bay area. Nearby San Francisco (easily accessible via the Bay area subway system, BART) is the greatest art and cultural center west of Chicago. The area supports two NFL, one NBA, one NHL, and two MLB teams, as well as a world class symphony orchestra, ballet, opera, and everything in between."

What Do You Like Least about Berkeley?

"Berkeley is a microcosm of the larger world, one that forces students to face many realities. Much like the real world, it can be merciless but it also can be compassionate. I like Berkeley because it's not like those private universities that pamper their students. It develops your character because even getting the classes you want requires a certain amount of determination. Although Berkeley may be harsh, it is excellent preparation for the real world."

"You have to grow up fast at Berkeley. I've matured considerably since I've been here. Many of this publication's readers will have come from programs where they are sheltered; Berkeley thrusts you into the real world, and quickly. No one holds your hand here."

"In terms of sheer brain power, no school matches Berkeley's faculty—7 Nobel laureates, 109 members of the National Academy of Sciences, more Guggenheim Fellows and Presidential Young Investigators than at any other university in the country. The competition is tough here, but the camaraderie that goes along with the competition more than makes up for it. Partly because engineering is so difficult, we know we must work together to make it through."

UC–BERKELEY

Berkeley, CA 94720
(510) 642-3175

- 4-year coed state university
- Urban campus on the edge of the Berkeley Hills (a nature and wildlife preserve), overlooking San Francisco Bay.
- Full-time undergraduate enrollment 1995-96: 10,940 men; 10,236 women.
- Special features: Adjacent to Lawrence Berkeley National Laboratory; two observatories; Space Sciences Laboratory; Center for Extreme Ultraviolet Astronomy; Mathematical Studies Research Institute; museums of art, anthropology, archaeology, and science; internationally known film archive; the largest library holdings west of the Mississippi.

What Do You Like Best about Berkeley?

Reviewers' least favorite aspect seems to be the bureaucracy and the assertiveness and persistence required to deal with it.

"Ironically, the same things that I mentioned in response to the last question—the fact that Berkeley makes you face real world challenges."

"There's very little I would change about Berkeley, but the most irritating part about being a student is going through the bureaucracy to get anything done. There are lines and red tape for everything. It takes perseverance; the school is flexible, but you must make it flex. Berkeley's first message to a new student is, 'Welcome to the real world.' It's a blessing in disguise. I'm ready for anything now."

Who Would Be Most Compatible with the Academic and Social Atmosphere at Berkeley?

*"There is something for every kind of student at Berkeley, whether you are quiet and academic, athletic, political, a social butterfly, cynical, ambitious, whacked out, or talented in extracurricular activities. Berkeley does, however, favor those who are aggressive; it is **not** a place for the timid. If you don't get what you want, you've got to persist and continue to try. The most successful students are intelligent, strong willed, and motivated. Political and 'street' naiveté are not good characteristics to have, unless one has the ability to adapt to these types of pressures."*

"At Berkeley you must be very self directed. Advising is often weak, so without a good sense of what you want, it would be easy to get lost in the sea of stuff here."

"The scientist-type (as opposed to the artist-type). The school is geared to research and study, and music is the only really strong art."

If You Had It to Do over Again, Would You Go to Berkeley?

All but one reviewer said yes. The one dissenter was an out-of-state student who turned down a scholarship to another school to attend Berkeley, and now feels that the difference in educational opportunity between the two institutions was not worth the cost incurred.

"Unquestionably. Not only am I gaining an unparalleled technical background, but I'm learning about life and the real world."

"God, yes. They were the best, most memorable four years of my life."

"Yes. I had wanted to go to a smaller, private college, but I'm quite happy and satisfied with being here. Berkeley has so much to offer—it's simply up to you to pay attention to the information and resources around you and to find what you want for yourself."

As you try to find the college or university best suited to you, the views of Berkeley presented above may be helpful. Keep in mind that these students might have had similar positive or negative experiences had they attended a different university. At any college, it is important for the individual student to seek out challenging academic experiences and the best professors, and to create a social life that best fits his or her personal style. ■

Note: The students quoted in the College Review Series are expressing their own views, which are not necessarily those of JHU or IAAY.

CREATIVE MINDS ImaGiNe...

Submit your creative work—brain teasers, short stories/essays/book reviews. We look forward to hearing from you.
Please write to *Imagine* • SET at IAAY • The Johns Hopkins University • Baltimore, MD 21218

Thirteen-year-old **Tenie Remmel** lives in Seattle, Washington, and is being home-schooled. He is studying college-level mathematics and science, enjoys computer programming, and is working on a packet of games for publication. Tenie also participates in gymnastics and competes on a swim team.

PUZZLE by Tenie Remmel

Directions:

1) The number in each square indicates the number of squares to jump in your next move. You may move up, down, left, or right.
2) Each move must travel a straight line; you cannot make dogleg moves.
3) Ignore the numbers in the squares that you jump on; numbers are relevant only in the squares that you *land* on.
4) You may jump on—but cannot land on—the squares (enclosed by dotted lines) that lie between the Start and Finish squares and the main boards. These squares do, however, count in computing jumps.
5) Squares A1 through A5 are airports. If you land on an airport, fly to the airport with the same name on one of the other boards, then move one square in any direction.

Hints: Beware of 0 squares; they are traps. So are squares 8 and up.

1	0	4	4	7	4	5	A1
6	A2	3	2	0	1	7	7
5	7	3	0	4	6	6	5
7	1	5	4	4	4	2	6
3	0	1	3	1	6	5	2
1	3	3	3	5	A3	3	2
6	6	3	0	3	6	0	4
0	2	4	A4	7	2	6	4

6 ← Start

4	0	1	6	3	2	2	7
3	A5	6	6	4	2	7	1
5	3	4	2	3	5	2	0
4	1	2	1	0	6	3	2
5	7	A4	5	3	4	1	4
7	0	1	6	2	1	6	7
4	6	0	2	0	5	A1	1
5	2	1	0	4	5	6	7

4	3	7	1	8	2	3	4
6	2	A3	0	1	5	5	1
7	6	3	2	3	6	4	7
4	0	3	3	7	4	4	2
5	1	0	2	1	6	A2	2
1	1	5	4	6	5	0	7
6	A5	2	0	1	7	1	7
4	3	7	1	7	6	9	3

Finish → ✿

MATHEMATICAL PROBLEM SOLVING TECHNIQUES by Alexander Saeed

Crazy Eights!

Here's a problem designed to show you just how versatile the number 8 can be. Using only the number 8 exactly eight times—along with addition, subtraction, multiplication, division, exponents, factorials, and parentheses—can you make the numbers from 1 to 100?

Are there any patterns that you find to be helpful? A few numbers will give you problems; which are they? The solution will appear in the next issue of *Imagine*.

Here's a sample to start you off:

100 = [8+((8+8)/8)] × [8+((8+8)/8)] = (8+2) × (8+2) = (10) × (10)
1 2 3 4 5 6 7 8 Exactly eight 8s!

Last June, 16-year-old **Alexander Saeed** graduated from The Johns Hopkins University as a biology/psychology major. (An article about his education will appear in the March/April issue of ***Imagine***.) When he's not busy creating math problems or figuring out their solutions, Alex spends his time doing research for a master's degree in psychology, writing, net surfing, and playing musical instruments.

VOLUME 3 • NUMBER 4

Opportunities and Resources for Academically Talented Youth

March/April 1996

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IAAY

Spotlight On

CONSIDERING MAGNET SCHOOLS & EARLY COLLEGE ENTRANCE

Students take a break at a magnet high school in Fairfax County, Virginia.

Too often today, educators seeking solutions to problems in American education try to find the answer in a single model or methodology. Then they feel disappointed when a too-simplistic reform effort doesn't produce the desired results.

In education, one size never fits all. To be effective, we as educators must recognize and value your individual differences as students. Only by identifying and promoting your diverse abilities and interests can we foster your development in all the professions needed to strengthen a thriving, creative, caring society.

Imagine's purpose is to acquaint you with a wide variety of learning environments and programmatic options both in and out of the classroom. In this issue, we spotlight magnet schools and early college entrance programs for those who need a more challenging environment than is found in many typical high schools. If such programs appeal to you, don't be discouraged by the fact that some schools we mention are restricted geographically. Consider those that do allow national enrollment, and find out what is currently—or may soon be—available in your own district or state.

Keep in mind that the education best suited to your individual needs will be the one that permits learning at the pace appropriate for you, nurtures your special abilities, encourages you to explore new interests. *And* keeps alive your love of learning. ■

Still Looking for a Summer Program?

If you haven't yet found your niche for the summer, consider these additions to information we included in the last issue of Imagine.

Enrichment
University of Northern Colorado Summer Enrichment Program for the Gifted and Talented
Grades 5-10, residential, two-week program of four academic courses each day (July 7-20, July 21-August 3).
Deadline: June 1
University of Northern Colorado Summer Enrichment Program (Grades 5-10), Greeley, Colorado 80639-0001.

Forensics
Lewis & Clark College Forensics Workshops
Grades 9-12, residential, two-week program (July 28-August 9) for beginning, intermediate, and advanced debaters and coaches: Team Policy Workshop or Lincoln-Douglas Workshop.
Deadline: July 8
Lewis & Clark College, Steve Hunt, Department of Communication, 0615 SW Palatine Hill Road, Portland, Oregon 97219-7899.

Although their official deadlines have passed, administrators of these two programs asked that their information be included here and noted that they will accept late applications on a space-available basis.

IAAY Academic Summer Program: Western Regional Office
SDB Learning Center
Entering grades 5-7; full-day four-week (June 27-July 26) commuter program at Harbor Day School, Corona del Mar, CA. All students take core classes in math, science, and language arts, plus "Discovery: Mapping Worlds," using research tools and images from NASA shuttle missions.
Late applications accepted on space-available basis.
SDB Learning Center, Johns Hopkins University-IAAY, 206 N. Jackson Street, Suite 304, Glendale, CA 91206; (818) 500-9034, fax (818) 500-9058

Study Abroad
Oxbridge Academic Programs
Ages 14-18, residential, July 2-26. Precollege courses offered at Oxford and Cambridge (9th graders) Universities and Académie de Paris. Includes excursions, workshops, concerts, and guest speakers. New for parents: one-week programs in England.
Oxbridge Academic Programs, Columbia University Station/Box250328, New York, NY 10025-1535; (800) 828-8349 or (212) 932-3049, fax (212) 663-8169.

1995-96 ADVISORY LIST

Recommended Resource:
Advisory List of International Educational Travel and Exchange Programs 1995-96 ($8.50), produced by the Council on Standards for International Educational Travel. *CSIET, 3 Loudoun Street SE, Leesburg, VA 22075; (703) 771-2040, fax (703) 771-2046.*

Remember to inquire also at local colleges and universities about possible precollege summer programs on campus.

Notes:

In the January/February issue of *Imagine*, photography by David Speckman, Interlochen Center for the Arts, appeared on pages 1, 3, 4 (columns 1 & 2), 6, and 8. Boston University Tanglewood Institute provided the photos on pages 4 (column 3) and 7.

Want to know more about the Study of Exceptional Talent (SET), which produces *Imagine*, and the Institute for the Academic Advancement of Youth (IAAY)? Check us out on the Web: *http://jhunix.hcf.jhu.edu/~setmentr*

Imagine...
*Opportunities and Resources for Academically Talented Youth**

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Special Schools for
Intellectually Talented Adolescents

by Julian C. Stanley, Ed.D.

In the 1970s, Professor Julian Stanley pioneered the talent search concept, using the SAT out of level to identify young students who reason exceptionally well mathematically and/or verbally. Since then, his research and other activities as director of the Study of Mathematically Precocious Youth at Johns Hopkins have established and promoted a variety of educational policies and practices that foster the development of academic talent. A consultant to several state residential high schools and a member of the Advisory Board of TAMS, he also has been a mentor and advisor to students who entered college early.

In this article, Dr. Stanley provides an overview of magnet high schools and early college opportunities for academically talented students.

Many extremely able high school students need more stimulation and challenge than most comprehensive high schools can provide. In response, a number of special secondary schools and early college options have been created to nurture such students properly.

Special Non-Residential High Schools

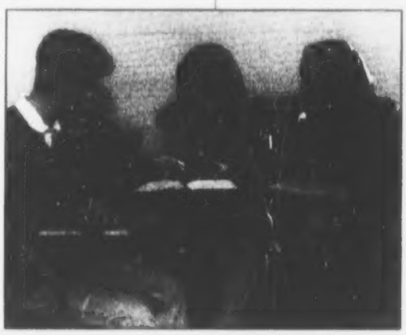
Among the earliest—and best known—are three non-residential, municipally-supported schools in the New York City area: Bronx High School of Science, Stuyvesant High School, and Hunter College High School for the Gifted.

Much more recently, highly selective and publicly funded Thomas Jefferson High School for Science and Technology was founded in Fairfax County, Virginia. Numerous other communities have also instituted magnet options for talented students, including Montgomery Blair High School in Montgomery County, Maryland (see pp. 6-7).

State Residential High Schools

In the 1970s, a new type of special school began to appear. The first was the North Carolina School of Science and Mathematics (NCSSM), offering the 11th and 12th grades. Selective, residential, and state-supported, NCSSM has been quite successful in helping bright students live up to their academic potential.

Before long, the NCSSM model—with some variations—was adopted in Louisiana, Illinois, Indiana, Alabama, Oklahoma, and several other states. Increasing interest in this model may lead eventually to its replication throughout the United States.



Students from The Advanced Academy of Georgia at West Georgia College

Early College Entrance

Another, related tradition began at the University of Chicago before World War II: early entrance to college by students who either were young high school graduates or had not earned a high school diploma.

In 1964, Simon's Rock was established in Great Barrington, Massachusetts, about fifty miles from its parent institution, Bard College. This early college entrance program was created solely to admit students who are a year or two away from completing their high school requirements.

These days, many standard colleges and universities will admit exceptional students a year or two—or even more—younger than typical freshmen. Some, such as The Johns Hopkins University, do not require high school graduation. (Hopkins' youngest-ever full-time undergraduate entered with a high school diploma and was 15 years 7 months old in 1981 when he received a B.A. in Physics, with general and departmental honors and the physics prize. He is now a highly productive researcher.)

One problem with colleges that admit underage freshmen is that few offer special provisions for these students' social and emotional development. Most early entrants either commute from home or live in residence halls without extra help and supervision. Many do not associate closely even with each other.

Among major early entrance programs that do take into account the student's social and emotional development are these four: the Program for the Exceptionally Gifted at Mary Baldwin College (women only) in Staunton, Virginia; the one-year Clarkson School of Clarkson University in Potsdam, New York; the Early Entrance Program (commuter only) at the University of Washington; and previously-mentioned Simon's Rock.

Another type of problem arises when young undergraduates—especially those who enter without diplomas—take whatever they please, perhaps never studying Shakespeare or other subjects usually covered in an academic high school curriculum. In a sense, they may skip much of their general education in order to accelerate their specialization.

High School and College

In 1988, a major new variant of early entrance programs was created at the University of North Texas in Denton: the state-chartered Texas Academy of Mathematics and Science (TAMS).

continued on next page

Each fall, about two hundred rigorously selected students enter TAMS after 10th grade. They must reside in a special residence hall on campus and be subject to some restrictions because of their age: no fraternities or sororities, no car the first year, no alcohol, etc. They have extensive social, athletic, and performing-arts interactions with each other during the two-year program.

TAMS students take perhaps the most rigorous set of college courses offered by any high school in the nation: two semesters each of biology, calculus, chemistry, and calculus-prerequisite physics, as well as eight semesters of social science and humanities. To earn a TAMS diploma, students must pass all these courses, plus several electives, with a cumulative GPA of at least 2.5.

TAMS graduates may remain at the University of North Texas, typically as juniors, to complete their bachelors' degrees, or they may transfer elsewhere. Many have chosen the University of Texas at Austin or Texas A & M; thus far, thirteen have enrolled at Johns Hopkins, where all have done well.

In the fall of 1995, state-supported West Georgia College—located fifty miles west of Atlanta in Carrollton—opened a more flexible, residential, early entrance program: the Advanced Academy. Students enter after 10th or 11th grade and complete their home high school's graduation requirements *in absentia* with college courses. Unlike TAMS, which is restricted to Texans, the Advanced Academy of West Georgia College admits students from anywhere in the U.S. and abroad.

So Many Choices . . .

The variety of programs outlined here —special non-residential high schools, state residential high schools, and various early college entrance plans—may appeal to different students, depending upon their needs and circumstances. In my opinion, all these options are needed to provide the range of special educational opportunities that students must have to achieve to their full potential. These models, along with The College Board's Advanced Placement Program, constitute some of the best possible options to raise the academic ceiling of most standard high school curricula. ■

SELECTED MAGNET HIGH SCHOOL & EARLY COLLEGE ENTRANCE PROGRAMS

For more complete information about opportunities within your state, check with your district administration or State Department of Education.

State Residential High Schools

Grades 11 & 12, unless otherwise indicated.

Alabama School of Fine Arts
Two divisions: Math and Science, grades 9-12; Fine Arts (Dance, Music, Creative Writing, Art and Theatre), grades 7-12. Also open to non-state residents, who pay tuition. *1800 8th Avenue North, Birmingham, AL 35203; (205) 252-9241, fax (205) 251-9541.*

Alabama School of Mathematics and Science
State/private-funded. *1255 Dauphin Street, Mobile, AL 36604; (334) 441-2120, fax (334) 433-0113.*

Arkansas School for Mathematics and Sciences
200 Whittington Avenue, Hot Springs, AR 71901; (501) 622-5100, fax (501) 622-5109, e-mail: davidr@asms1.k12.ar.us

Illinois Mathematics and Science Academy
Grades 10-12 (see p. 5). *1500 West Sullivan Road, Aurora, IL 60506-1000; (708) 907-5027, fax (708) 907-5062, info e-mail: brenda@imsa.edu*

Indiana Academy for Science, Mathematics and Humanities
Ball State University, Muncie, IN 47306; (317) 285-8105, fax (317) 285-8986.

Louisiana School for Math, Science, and the Arts
c/o Northwestern State University, 715 College Avenue, Natchitoches, LA 71457; (318) 357-3173, fax (318) 357-3299.

The Maine School of Science and Mathematics
Maine residents funded by state; students from other New England states, Quebec and New Brunswick, Canada, pay tuition, room and board. *75 High Street, Limestone, ME 04750; (207) 325-3303 or (800) 325-4484, fax (207) 325-3340, info e-mail: sandra@mssm.lcs.k12.me.us*

The Mississippi School for Mathematics and Science
1314 5th Avenue South, Columbus, MS 39701; (601) 329-7687, fax (601) 329-7205.

North Carolina School of Science and Mathematics
1219 Broad Street, Durham, NC 27715; (919) 286-3366 x203, fax (919) 286-5960, e-mail: stein@opus.ncssm.edu

Oklahoma School of Science and Mathematics
1141 North Lincoln Boulevard, Oklahoma City, OK 73104; (405) 521-6436, fax (405) 521-6442, e-mail: dlyon@ossm.edu (web) http://www.ossm.edu/index.html

South Carolina Governor's School for Science and Mathematics
306 East Home Avenue, Hartsville, SC 29550; (803) 383-3944, fax (803) 383-3903.

Early College Programs

Grades 11–12, residential, unless otherwise indicated.

The Advanced Academy of Georgia
Students enroll in absentia in their own high schools, concurrently earn high school and college credit. Non-state residents also accepted. Tuition, fees, room and board assessed on resident/non-resident basis. *West Georgia College, Carrollton, GA 30118; (770) 836-4647, fax (770) 836-6720.*

Boston University Academy
Grades 9-12, commuter only. Tuition charged; non-state residents accepted. Students in grades 11 & 12 enroll for credit at BU. *One University Road, Boston, MA 02215; (617) 353-9000, fax (617) 353-8999, (web) http://academy-www.bu.edu*

The Clarkson School
Residential; 40% are NY residents. Bridging Year offers transition between high school and college for accelerated students; completion allows college entrance with sophomore standing. Courses taught by Clarkson University faculty and taken with Clarkson University students. *Clarkson University, Potsdam, NY 13699-5650; (315) 268-4425, fax (315) 268-7991, e-mail: tcs@agent.clarkson.edu*

continued on page 8

Having taught mathematics at IMSA for the past two academic years, Dr. Fogel brings a somewhat different perspective to the subject of magnet schools than do the student writers whose articles follow.

WHAT'S IMSA?

by Micah Fogel, Ph.D.

Imagine a high school where the students respect the mathletes as much as the athletes. Where all faculty have advanced degrees (a quarter of them doctorates) and many have eschewed research careers at universities to teach there. Where the average combined SAT score in 1995 was 1325, where nearly half the graduating class are National Merit Scholarship qualifiers, and where students once achieved the only perfect team score in the history of the American High School Mathematics Exam.

For the 650 academically talented students at the Illinois Mathematics and Science Academy, this place is a reality.

Then . . .

In the early 1980s, several studies showed the United States falling behind in math and science education. The state of Illinois decided on an aggressive school improvement plan and implemented several programs. One was an idea from Nobel Prize-winning physicist Leon Lederman: a residential learning environment for students talented in mathematics and science, where the students could fully develop their abilities and where the faculty could develop innovative programs and ideas to share with other teachers, students, and schools throughout the state and the nation. Lederman—along with a group of business, government, and educational leaders—pitched this vision to the state legislature, and IMSA was born.

The program was located in suburban Aurora for a number of reasons. Aurora is about 35 miles west of Chicago, the state's largest population center. Its proximity to many of Illinois' research and industrial centers (such as Fermilab, Amoco, and Motorola) and universities (such as Northwestern and the University of Chicago) would enhance program offerings. *And* the town offered a new, unused school building located on a campus large enough to hold the residence halls that would have to be built since IMSA would serve the entire state of Illinois. In fact, all students would live on campus even if their homes were nearby; this residency requirement fosters a sense of community and allows IMSA to bolster its academic programs with appropriate social programs.

Opening with the 1986-87 academic year, IMSA experienced many growing pains. Before the residence halls were built, students actually had to live in the school building itself—especially troublesome when part of the ceiling collapsed following a heavy rain. Funding for the program, scheduled to run out midway through the second year, was only extended through a mammoth lobbying session at the state legislature by the entire IMSA community: students, staff, and faculty.

DIGIT Photographs

IMSA students at work on a technical project.

And Now . . .

Nevertheless, IMSA survived and has become one of the most successful experiments in American education. "Experiment" is the appropriate term. While many programs at IMSA are similar to those at other high schools, others follow innovative paths in an attempt to make education better for IMSA students and, we hope, for students across the nation.

In one program, students assigned to design a Mars colony have to learn about the physics, biology, chemistry, ecology, and other science necessary for successful completion of the project. The precalculus mathematics courses are based on investigating various themes common to algebra and geometry, instead of focusing on specific topics. Upperclassmen may take advanced courses such as number theory, astrophysics, genetics, or microeconomics. They may also participate in mentorship programs, where they spend one day each week as a member of a research team in an industrial or university laboratory. And much of the learning at IMSA is done cooperatively in small groups, where students often learn more from each other than from their teachers.

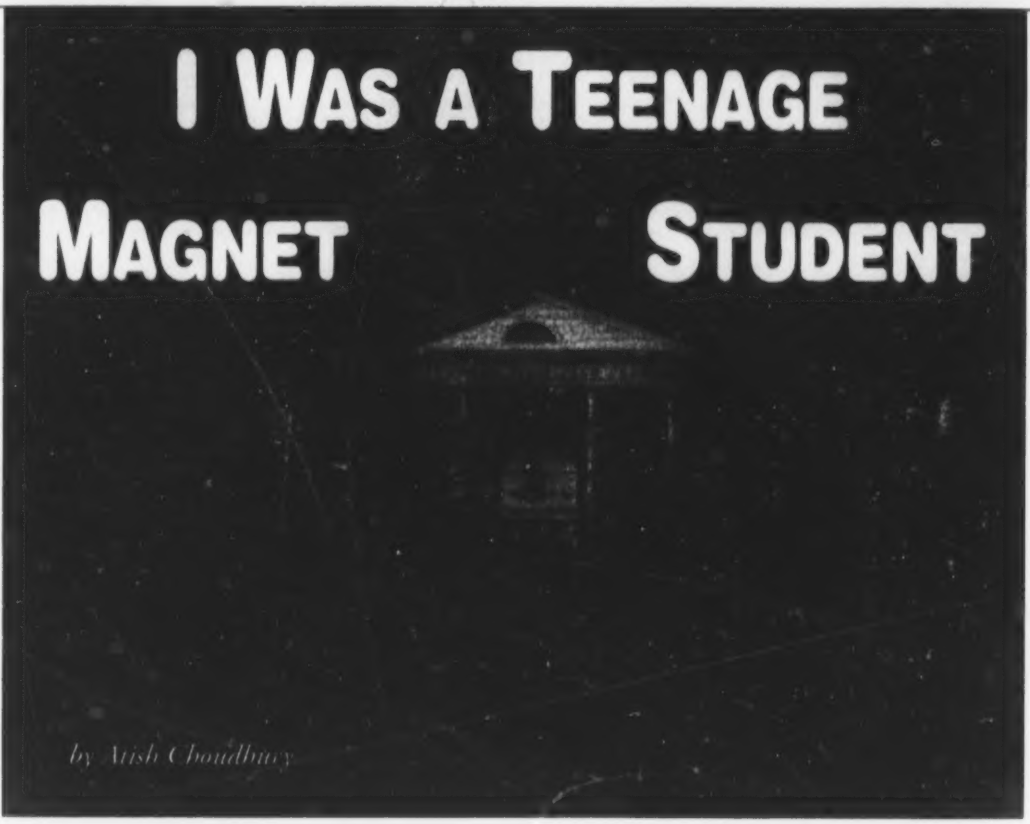
Academic requirements are, of course, stringent. Students must take math and science courses throughout their stay at IMSA and must complete three years of English, two and a half of social sciences, and two of foreign languages. In addition, they must fulfill requirements in fine arts, community service, and campus work-service. Most students take far more than the minimum and often lobby the faculty to work with them on independent study projects.

While IMSA academics are very intense, the social aspects of the program can't be ignored. As the nation's only three- year residential program for talented students, IMSA offers many opportunities that are unavailable anywhere else. Residential life is much like life in a college dormitory, where study groups and impromptu dance parties form with equal ease. Because of their smaller numbers, students here get to know almost everyone else at the school and form many close relationships. Since most students are under 18 during their three-year tenure at IMSA, faculty and staff provide student supervision, and adult Resident Counselors fill in as parents and big brothers and sisters. Living closely together helps students learn patience and tolerance and gives them valuable experience in fending for themselves.

It is hard to sum up the IMSA experience. It's definitely the kind of high school I wish I could have attended. These are definitely the kinds of faculty and students I want to work with. But IMSA goes far beyond the place and the people and the programs. IMSA actually is the place you would imagine it to be. ■

Following his 7th grade year, ***Micah Fogel*** *entered the University of Washington via its Early Entrance Program. He received his Ph.D. in mathematics from Berkeley in 1993. Dr. Fogel can be reached by phone at (708) 907-5965 or e-mail: fogel@imsa.edu*

I WAS A TEENAGE MAGNET STUDENT



by Atish Choudhury

The school towered over me like a giant, as I slowly stepped out of the bus and stared wide-eyed at the place that would be my daytime home for the next four years. Students all around me flocked toward the door like ants to an anthole, while I just stood there. Anxieties about harder classes, better students, more demanding teachers all swirled through my head. Finally, I swallowed the frog in my throat and resolutely walked to the door, marking the beginning of my new life. . . .

Obviously, I am being melodramatic. But the idea of entering a new magnet school—where the students were among the best in the county and where I knew only a couple of people just barely—did leave me feeling very intimidated. Between the time of my acceptance and my decision to enter the program, I thought about the fact that my local high school was certainly academically acceptable; I wondered if it was necessary to enter the unexplored territory of new classes, new friends, new society. Of course, my parents—not compromising in what they saw as best for my education—were firm that I would have to go. Thank goodness for parents.

Many magnet programs are whole-school models. However, Montgomery Blair High School's Math, Science, Computer Science program represents a community of about 400 students within the framework of a much larger public high school with a total student population of 2,400. This alternative environment offers advanced courses with special opportunities to some of the best students in Montgomery County, Maryland. They are chosen through a process similar to that of college admissions: standardized tests, an academic transcript, outside activities, and an essay.

Benefits of a Math/Science Magnet School

The Classes

Options offered within the Blair magnet program include multivariate calculus, linear algebra, complex analysis, mathematical physics, cell physiology, genetics, software design, research and experimentation—along with many others that cannot be found at most public schools. Add to this list the classes that are part of the Advanced Placement program and you can find yourself accelerating rapidly in a short period of time.

The Teachers

Along with the small community of magnet students within the larger school, the community of magnet teachers is also fairly small. Thus the teacher is more likely to know a student before the class even starts. Immediately acknowledging the ability of their students, teachers move the subject matter along at a rapid pace. The downside is that it's often difficult to impress teachers who've seen it all before.

The Facilities

Magnet schools are usually well funded by their school districts and have the facilities to prove it. Ours was the first high school in the county to be wired to the Internet, at a time when almost no one knew what the Internet was. The Research and Experimentation lab looks slightly like a woodshop classroom, but contains another computer lab to help program robots and perform certain calculations.

The Opportunities

The Blair magnet program prides itself on exposing students to the scientific process. Each of the major projects performed by magnet students starting in freshman year involves research, scientific

fiction
fact
FACT
FICTION
fact
fiction

writing, and formal presentation. These projects include building a tester to gauge the strength of coffee, designing and constructing a robot equipped with a sensor to collect data, conducting ecosystem research on Wallops Island in Virginia, and completing an engineering project (including patent search, design, construction, and testing). The Senior Research Project, which takes one to one-and-a-half years to complete, is the culmination of the previous years' work.

The Student Body

I consider this aspect of the magnet program to have been the most important for my own self-improvement. When a class is filled with students interested in learning (even if they won't admit it) and able to take in information quickly, the pace is faster, the material becomes more challenging, and each student must work harder to keep up and especially to excel.

Another plus for me—since I enjoy competing on academic teams—was Blair's history of excelling in national competitions. For example, Blair students become finalists in the Westinghouse Science Talent Search on a regular basis; in fact, Blair students won three of the top ten slots in 1993, finished fourth in 1995, and placed first in 1996 (see pp. 14-15 for this year's STS results). Blair consistently places among the top schools in the Knowledge Master Open, the American Computer Science League, and the American High School Mathematics Exam, among others. Because of the high achievements of my peers, competition goals that may have seemed unattainable for me at my local high school were within my reach at Blair. (I wouldn't have imagined I could captain the Blair team that won the 1995 "It's Academic!" Super Bowl.)

Misconceptions about Math/Science Magnet Programs

Fiction: *"Being in a magnet program separates you from other high school students."*

Fact: This may be true for whole-school models, especially residential programs. However, Blair's model, while fostering a sense of community among its magnet students, in no way discourages association with the other students in the building. Only the math/science/computer science classes are exclusively magnet; even then, non-magnet students with the prerequisites are welcome to take many magnet classes. All other periods—including English, history, foreign languages, and physical education (and lunch)—are completely mixed. Almost without exception, magnet students do find friends within the school outside the program.

Fiction: *"Participation in outside activities by magnet students is limited by their heavy workload."*

Fact: At Blair, many magnet students—often a disproportionate number—are involved in the student government association, sports teams, band, orchestra, theatre groups, and other clubs and projects. It's true that time is a big problem (especially given that the magnet day has eight periods, while the rest of the school has seven), but that usually does not stop students from participating in many extracurricular activities.

Fiction: *"A math/science program will not provide the accelerated humanities classes that magnet students also need."*

Fact: Often, academic talent in the sciences carries over into the humanities as well. Highly able students expect to be challenged in every class, and their presence fuels further acceleration of high-level courses, such as APs, already being offered across the curriculum. Evidence of its excellence in the humanities can be seen in the consistently high scores achieved by Blair students on AP exams in English, history, and foreign languages.

Fiction: *"A math/science magnet program is only for someone who plans a career in one of these fields."*

Fact: In fact, many magnet graduates go on to major in subjects other than math or science. Anyone who is interested in the sciences and is looking for a fast-paced, academically challenging program should definitely consider a magnet program as an option.

Fiction: *"Being a magnet student guarantees acceptance by one's first-choice college."*

Fact: Unfortunately, this is just not true. Because classes are harder and competition is greater, it's definitely more difficult to shine and be the best; your GPA will probably not be as high in a highly competitive magnet program as in a standard high school. Even though college admissions officers may take into account the rigors of a magnet program, the simple fact is that Harvard can only accept so many students from one school.

Conclusion

While this last point may strike quite a blow to the idea of attending a magnet school, it should not deter those who really care about their learning. The primary goal of attending a magnet school is self-improvement. Even though magnet students may not always be accepted into their first-choice college, inevitably they do find their place. And once in a top college, they generally discover that they are more accustomed to hard work, late nights, and a competitive environment than are many of their highly intelligent peers who did not attend magnet schools.

Yes, a magnet program can sometimes leave you feeling frustrated and stressed. However, I cannot think of any other high school accessible to me where I would have gotten a better education. I am now doing well in college and feel as though I can handle almost any challenge thrown at me. After all, I've had to do it before. ■

***Atish Choudhury** graduated in June 1995 from Montgomery Blair's Math, Science, Computer Science magnet program. He is now a first-year sophomore majoring in chemistry at The Johns Hopkins University. Atish is currently working as a technical assistant for the Study of Exceptional Talent at IAAY.*

continued from page 4

Early Entrance Program (EEP),
California State University: Los Angeles
Two-year, college-credit commuter program. State residents eligible if 11 to 15-1/2 years old with combined score >1000 on Washington PreCollege Test. *California State University at Los Angeles, 5151 State University Drive, Los Angeles, CA 90032-8227; (213) 343-2287, fax (213) 343-2281, info e-mail: rmaddox@csla.edu*

Early Entrance Program (EEP),
University of Washington
State residents only, under 15; tuition and fees charged. Students commute at least first two years of two-step program: one-year, intensive college-prep Transition School, then full-time studies at University of Washington. *Halbert Robinson Center for the Study of Capable Youth, University of Washington, Guthrie Annex II, Box 351630, Seattle, WA 98195-1630; (206) 543-4160, fax (206) 685-3157,*
info e-mail: capable@u.washington.edu

Program for the Exceptionally Gifted (PEG),
Mary Baldwin College
Residential; young women only, from U.S. and Canada. Students enter anytime after 9th grade; eligible to receive B.A. after completing four-year program. *Mary Baldwin College, Staunton, VA 24401-9983; (540) 887-7039, fax (540) 887-7187.*

Simon's Rock College of Bard
Residential; non-state residents also accepted. Students enroll after 10th or 11th grade in A.A. program, may remain to complete B.A. Twenty two-year full scholarships awarded annually. *84 Alford Road, Great Barrington, MA 01230-1559; (800) 235-7186 or (413) 528-7312, fax (413) 528-7334, e-mail: admit@plato.simons-rock.edu*

Texas Academy of Mathematics and Science (TAMS)
State residents only; tuition, room and board charged. Students concurrently complete last two years of high school and first two years of college. *University of North Texas, P.O. Box 5307, Denton, TX 76203; (817) 565-3971, fax (817) 369-8796,*
e-mail: schumach@tams.unt.edu

Texas Academy of Leadership
in the Humanities (TALH)
Non-state residents also accepted. Lamar University scholarships pay tuition and fees, but not room and board. Students enroll concurrently in their own high school, must complete graduation requirements. *Lamar University, P.O. Box 10034, Beaumont, TX 77710; (409) 880-8046, fax (409) 880-8384.*

When you're looking for educational resources, sometimes the best answer is not always the most obvious one. So be sure to consider all your options.

INTERLOCHEN ARTS ACADEMY: Choosing Another Path

by Kate Young

Getting the best education is important to me, but finding the *right* high school was a challenge. I had some concerns about my local school. In rural northern Michigan, where my family lives, school systems are small and offer a limited number of courses, with classes numbering 35-45 students. Because I had already taken some high school classes as an eighth grader, I would have run out of math and science classes by my junior year, but would still have had to complete four years of high school.

So I began to consider alternatives. My parents and I discussed several options: transferring to the largest public school within a reasonable distance, attending a diocesan school almost an hour's drive away, moving in with relatives to attend another parochial school—or entering the private, residential Interlochen Arts Academy.

Not Just an Arts School

Attracted by Interlochen's artistic reputation, I discovered when we visited that this school also has much to offer academically.

Interlochen Arts Academy is the high school division of the Interlochen Center for the Arts. The Academy was founded in 1962 as an outgrowth of the eight-week summer program now known as Interlochen Arts Camp (formerly, National Music Camp). Set on 1,200 wooded acres between two glacial lakes in northern Michigan, the Academy offers pre-professional arts training combined with a strong precollege education for students in grades 9-12. (Three-quarters of the student population transfer to Interlochen as juniors and seniors: only 19 members of my senior class completed all four years at the Academy.)

Interlochen students may choose to major in one of several arts fields—Creative Writing, Dance, Music, Theatre Arts, and Visual Art—or in Academics. All students, regardless of their chosen majors, combine arts classes with a standard precollege curriculum.

The Academy's math department offers courses from Algebra I through calculus. Science options include biology, anatomy, geology, ecology, physics, and two years of chemistry. Choices in foreign languages are French, German, and Spanish. Literature courses range from Modern European Literature and Contemporary American Classics to Shakespeare, Psychological Literature, Russian Literature, and Destiny in World Literature. History and political science courses explore the evolution of the political process and Western thought, current American and constitutional political processes, and diplomacy throughout U.S. history.

Finding What I Needed

Planning a career in medicine, I chose Academics. Because I spent more time than most in the academic environment, I was able to develop skills as a tutor and participate in extracurricular academic functions: I competed on math teams and was involved in environmental testing of a local stream for pollutants.

For me, the arts component provided a refreshing break from academics. As a freshman, I played the flute; my musical interests later turned to the piano and the organ. Practicing became a release, something to relax and interest me outside of academic pursuits. Visiting artists taught us in master classes; evenings, we attended recitals, performances, readings, and exhibitions.

The Best Part

Entering Interlochen as a freshman, I matured quickly and soon learned how important it is to develop and maintain friendships. Today I continue to write, call, or e-mail best friends from those years. In the artistic world, it's hard to find a person who hasn't attended programs at—or doesn't know someone from—Interlochen. So even now my friendships continue to grow from that foundation. ■

***Kate Young** is now a first-semester junior at Johns Hopkins, majoring in biology and minoring in psychology. She notes, "Interlochen prepared me for Hopkins by fostering my dedication and integrity and by teaching me to have a passion for and gain enjoyment from what I do." Kate plans to attend medical school.*

For information on Interlochen: http://www.traverse.com/~interlochen

THE GOVERNOR'S SCHOOL FOR GOVERNMENT AND INTERNATIONAL STUDIES:

Not Just a Random Bunch of Geeks

by Katy Wischow

One day in eighth grade, I sat at a lunch table in the cafeteria, checked a box on a blue piece of paper, and made a decision that truly changed my life. I had checked yes on the invitation to attend The Governor's School for Government and International Studies, a public magnet school in Richmond, Virginia.

Eighth graders at my middle school were given information about The Governor's School, and I knew of other students who had attended. I decided to apply because most of my friends in advanced classes were interested and because I wanted to keep that option open. The application requirements are fairly uncomplicated: standardized test scores and transcript, an essay, two teacher recommendations (one from a social studies or foreign language teacher), extracurricular activities and awards, and a test.

Unsure of what to expect, I went to The Governor's School to take the test one Saturday in May. It seemed like an intelligence test: shapes fitting into boxes, patterns, colored drawings. We also had to write another essay on a topic we were given that morning; the question for that year was to pick what you considered to be the most significant moment in American history and explain its importance. (The hardest part was choosing a moment!)

I was pleased to be accepted, but my first day of school last year found me with a lot of doubts: Would I be able to do well? Would I like it? Would I miss the friends I was leaving behind? But by second semester, when people asked where I went to school, then gave me a strange look and said, "Oh. Well, how do you like it?" I responded immediately, "I love it!" And I still do.

About 550 students currently attend the commuter program at The Governor's School, which draws its student body from sixteen cities and counties around Richmond. As the name indicates, the school's official theme is government and international studies. Its diploma requirements in these areas are more extensive than the state's requirements: four years of one language and two years of another; four social studies courses instead of three. The other diploma requirements are much the same as the state's, but The Governor's School offers many more courses than most of our home schools do.

The Governor's School aims to attract gifted students who don't necessarily have advanced options in their home schools. (My parents, remembering the slim offerings at their own high schools, marvelled at the course booklet I brought home.) All Governor's classes are honors level, and "plus" options exist in language classes and in some math and science classes. Plus classes are faster paced and cover material in more depth, so are more interesting to students who enter with strong backgrounds. Governor's offers most of the Advanced Placement courses, and professors from nearby Virginia Commonwealth University come to Governor's to teach college-level courses for college credit.

The Governor's School uses block scheduling, with eight courses per academic year. Some classes meet on Monday/Wednesday, the remainder on Tuesday/Thursday, and all eight on Friday. The block classes last an hour and a half, giving us more time for activities and labs. I wasn't sure how I'd like sitting in one class that long, but now I love the extra activities and am so used to the longer schedule that Fridays seem strange.

The desks in every Governor's classroom are arranged in groups or in a large circle, a fact that amazed me when I first visited. Since then, I've realized that the group work we do is one of the best things about my school. I also appreciate having smaller classes; for example, my algebra class has only twelve students, affording all of us more individual help and creating great class rapport.

The Governor's School emphasizes multiculturalism and interdisciplinary learning. Assemblies have included programs for African American History Month, and a presentation on India is scheduled in May. Foreign exchange and travel programs are highly encouraged. Any focus area being discussed in the two-year required Global Studies course is integrated when possible into other classes. For example, when the focus area was the Middle East, our English class read Kahlil Gibran's *Broken Wings*. When the focus was Africa the biology class researched African biomes. And when we studied South American cultures, a speaker discussed concepts of mathematics among ancient civilizations on that continent. The different viewpoints provided through interdisciplinary learning enable us to learn a tremendous amount about an area of the world that could have been just a unit in history class.

The Governor's School isn't perfect, though. For one thing, it gets annoying dealing with the perception that our school is elitist and explaining ourselves to random strangers *ad nauseam*. For another, we do have a lot of work, and the pile of reading, projects, and assignments can become overwhelming. What I've learned at Governor's, though, is that it's quite possible to get it all done. I have time for acting, school activities, and my friends, without staying up all night.

Of course, I *have* wondered at times. . . . If I'd stayed at my home school, I might have lived out the stereotypical high school experience. But then again, I would have missed so much that is unique to The Governor's School. The special activities, involvement in competitions, demanding courses, students who are as excited by the intellectual challenge as I am, friends who are engaging, funny, and talented—all these make attending The Governor's School so rewarding for me.

Looking back to that day in the cafeteria, I'm confident that I made the right choice. ■

Now a sophomore at The Governor's School for Government and International Studies, ***Katy Wischow*** *loves writing, theater, and friends. She captains a "wonderful" Odyssey of the Mind team which won at the regional level and will compete at the state finals in Radford, Virginia.*

For information: *The Governor's School for Government and International Studies, 4100 West Grace Street, Richmond, VA 23230; (804) 780-6155, fax (804) 780-6043.*

At Johns Hopkins' May graduation, this author will receive both a B.A. in Biology and Psychology and an M.A. in Psychology. Here he describes the factors that led to his beginning college courses at an exceptionally young age. The path he chose is not recommended for everyone, but it worked for him.

Early College Entrance: No Regrets

by Alexander I. Saeed

Stop me if you've heard this one. It's the first day of the first grade. As a new student, you spend time learning your way around the school. You talk with other kids, memorizing their names and finding out their interests.

Then your teacher announces that it's time for math, and you almost jump to your feet. Math has been an interest of yours since, well, forever. (You insist on adding the grocery prices in the supermarket, and at the register you tell the cashier the exact number of coins you should get as change.) So you eagerly stuff your papers in your desk and join the other students on the carpet in front of the blackboard. And the lesson begins. Your teacher announces that you're going to . . . count dots.

Disheartened, you participate in an activity that you feel is pointless. You ***know*** *how to count dots. You can add, subtract, multiply, and divide. Your mom is teaching you fractions at home. And yet, here in your "intellectual home," you feel you're stuck doing chores.*

That night, at the dinner table, your parents ask the usual question, "How was school?" And you respond with the typical, "Okay." But finally, you tell your parents about the math dilemma.

Of course, not every academically talented student has this experience in exactly the same way, at the same age, or in the same subject. But for most of us, there comes a time in our academic careers when the standard curriculum just doesn't fit our needs.

What happens next may depend a great deal on the individual school administration. I was fortunate. My parents talked with the principal, who was cooperative. Diagnostic tests placed my mathematical abilities far above grade level. Finally, I was moved to fifth grade for math.

For second grade, we tried the private school option, looking for more challenging coursework in all areas. But my parents and I were not completely satisfied with any particular private school, so I spent the year "school hopping."

I returned to public school for third grade and, from then until I left elementary school after fifth grade, was placed in upper-grade math classes. Through this experience, I became accustomed to being around older students.

After fifth grade, I spent the fall semester taking seventh-grade general courses and high school biology and pre-calculus. I also enrolled in a Johns Hopkins' evening course in chemistry.

You wouldn't be able to tell how young I am *now* by looking at or listening to me, but when I started that chemistry class at age 11, my youth was obvious. My dad drove me to the Hopkins campus and helped me find the classroom, then went to wait in the library for the three-hour class to finish. I took my seat and waited for the lecture to begin. The professor, whom we had passed earlier in the hallway, walked over to me, and this befuddling conversation ensued:

"Where's your dad?"

"He's in the library."

"Tell him he should try to attend the class."

(Pause.) "Why?"

"Son, when a student enrolls in a course, he does better when he actually *attends* the class."

Shocked to discover *I* was enrolled, he was stunned when I finished the course with an *A*.

Because my academic background was strong (due to extensive home study) and because I felt comfortable with much older students, by spring semester it seemed logical to jump to full-time college. I decided to enroll at my local community college, where I enjoyed the diversity of courses and the campus atmosphere for a semester. Following a year's hiatus—because the county school board insisted that I return to public school for eighth grade—I completed an associate's degree and entered Johns Hopkins as a 14-year-old first-semester junior in January '94.

Early entrance gave me a chance to pursue the disciplines that interested me, and independent work provided the opportunity to seek my own path. Homework was no longer a chore to do before dinner, but almost an immersion in the subject, a taste of what was to come. Certainly, my motivation to learn was highest during my time in college.

Early entrance also bestowed upon me that most precious of commodities: time. I was able to indulge all my interests and take more courses than my degrees required. I had the opportunity to explore a diverse array of subjects, making sure not to rush into a major that wasn't right for me. After deciding on a double major (biology and psychology), I was at liberty to surge ahead, tackling research problems and advanced classes.

I was also eager to take full advantage of the innumerable non-academic facets of college: I lived in the dormitories, joined clubs and served in student government, volunteered for jobs on campus to get the feel of a professional atmosphere, and attended as many events as I could fit into my schedule.

Looking back over my undergraduate years, I feel lucky. I did not experience any age discrimination, despite my youth. I received no ridicule from my intellectual peers, and I never felt isolated from them. I have never regretted choosing early entrance.

Considering early college entrance for yourself? My best advice is to be sure all your academic abilities are up to "specs." If you are the next Pythagoras but are sliding by in the humanities, consider taking one or two college courses while staying in high school to round out your education—and your life. Evaluate all options carefully so that college, when you're truly ready, will prove to be the challenging and exciting experience you anticipate. ■

Alex Saeed, *who will be 17 on May 7, is currently doing research in molecular biology under Nobel laureate Dr. Hamilton Smith, while he considers pursuing an M.D. or Ph.D.*

Early College Entrance:

Is It Right for You?

*by Linda E. Brody, Ed.D., and Julian C. Stanley, Ed.D.**

If you're thinking about entering college two or more years younger than the typical freshman, you'll want to consider many factors.

First, thoroughly assess yourself: your abilities, social and emotional maturity, content knowledge, motivation, and long-term goals.

Next, weigh your academic alternatives: the resources available through your public school or other high school environments, and the particulars of the college(s) that interest you. Consider whether you have taken full advantage of the challenging opportunities available to you *now* before considering moving on.

Then, evaluate whether your academic and social needs can best be met by enrolling as a full-time college student at this time in your life. For those struggling with the positive and negative aspects of this decision, the following points may be helpful.

Possible Positive Consequences

- Because acceleration provides greater challenges, early entrants may be more highly motivated and less bored throughout their school years.
- Exposure to their intellectual peers may enhance peer relationships for early entrants.
- Because early entrants are younger when graduating from college, they may be more likely to pursue graduate studies.
- Using the additional time gained, early entrants may choose to pursue degrees in several fields, thus becoming more fulfilled personally and bringing a broader background to their careers.
- Early entrants may be more productive in their careers, since they can begin work at a younger age when productivity and perhaps creativity are likely to be highest.

Possible Negative Consequences

- Certain experiences in high school—such as being selected for a leadership position—may be missed if a student spends less than four years there.
- Early entrants may find themselves attending a less selective college/university than they might at the typical age. This may happen because they choose to live at or near home, or because they haven't had enough time to develop the background and credentials required by a more selective institution.
- Difficulties in peer relations may arise if early entrants have trouble relating to older students or are excluded from social events because of age.
- Competing in certain extracurricular activities in college, such as sports or music, may be a problem for early entrants because of their smaller stature or fewer years spent developing relevant skills.
- Acceleration may encourage early entrants to focus on a major field when they haven't had enough life experience to make this important decision wisely.
- As younger graduates, early entrants may experience discrimination after college because of age—for example, when applying to medical school or job hunting.

If you decide that early college entrance is the right path for you, take note of recommendations below for enhancing your likelihood of success.

Making Early College Entrance More Effective

- ***Be clear that this is your decision.*** Are you highly motivated and eager about this prospect, or are you feeling pushed into it by others?
- ***Evaluate any regrets you might have:***
  a) if, by leaving high school without graduating, you will miss extracurricular activities and other aspects of the precollege experience;
  b) if early entrance will alter your potential college experience—for example, if you will attend a less selective college or live at home instead of in a dorm.
- ***Develop outside interests and hobbies*** such as athletics and the performing arts, so you can benefit from interaction with a variety of peer groups.
- ***Seek out opportunities to interact with older students*** through advanced coursework and summer programs while you're still in high school, so you'll be comfortable socializing with students several years older when you enter college.
- ***Confirm that both your mathematical and verbal reasoning abilities are strong.*** Your SAT or ACT scores should be at least average (preferably higher) for the specific college or university you will attend.
- ***Ensure that your knowledge level will be similar to that of other highly able college freshmen.*** Before entering college full-time, complete some advanced coursework (Advanced Placement courses, 12th grade honors courses, and/or part-time college courses); and take appropriate standardized achievement tests (SAT II, AP tests).
- ***Consider commuting to college, at least at first,*** to minimize adjustment difficulties if you are particularly young.
- ***Avoid publicity.*** Media attention on "prodigies" can create exaggerated expectations among professors and classmates and may foster emotional difficulties for early entrants.

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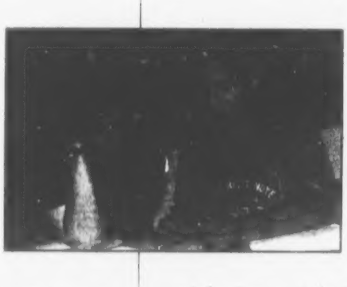
*This article was adapted from "Young College Students: Assessing Factors that Contribute to Success" by L.E. Brody and J.C. Stanley. In W.T. Southern and E.D. Jones (eds.), *The Academic Acceleration of Gifted Children* (pp. 102–132), Teachers College Press, New York, 1991.

Getting the Best Precollege Education . . . at Your Local High School



Choosing the magnet high school or early college options profiled in this issue of *Imagine* typically involves leaving your friends to attend a school outside your neighborhood; most options even require leaving home to live in a residential setting. Although these environments offer many academic and social advantages, they are not for everyone.

What if you don't want to leave home? Or suppose you apply, but aren't accepted? Or your state doesn't have a magnet school, and you don't feel ready for college? Can you possibly get a good education at your neighborhood high school? And get into a highly selective college?

Of course!

While magnet schools offer an array of challenging advanced courses and other opportunities under one roof, you *can*—with some effort—put together a program to meet your own needs by taking full advantage of resources in your school and community.

First, determine your needs. Consider your strengths, weaknesses, interests, goals, and aspirations. If necessary, seek assistance from teachers and/or academic counselors in evaluating these aspects of yourself. How highly challenging a program do you need? Should you accelerate in all coursework, or are your strengths primarily in one subject area?

Then, consider your options to design a precollege program that meets your unique needs—an "Optimal Match." Work with your school to devise the best possible program for you and supplement that program with learning experiences outside school.

Take full advantage of what your school offers. What options are available to you? Honors or Advanced Placement classes? An International Baccalaureate program? Opportunities to do independent research? Match these options to your abilities, and create the most challenging program appropriate for you.

Seek curricular flexibility. Consider the level and pace of instruction as you select your courses. If you need more advanced coursework than is typically offered at your grade level, request permission to modify your schedule. For example, a middle schooler might go to the local high school for more advanced math, or a student might jump right into an AP course without taking the easier prerequisite. If the option you seek is not available within your school system, talk to your administrators about an alternative course outside school.

Pursue supplemental opportunities. Bear in mind that learning occurs anywhere and everywhere. Look beyond the high school curriculum to correspondence, summer, and part-time college courses. Seek mentorships and internships outside school. Participate in intellectually challenging extracurricular activities such as academic competitions. Use your leisure time to read, travel, socialize with friends, and pursue special interests.

Take responsibility for your own learning. Don't let a lockstep curriculum lull you into losing your motivation and drive. As a student who is highly able in one or more areas, you need to be actively involved in determining your own academic path—especially if you expect the learning process to include a high level of challenge and enjoyment.

Based on your own energy, abilities, and aspirations, *you* should choose the level of difficulty of your coursework during the high school years, as well as the intensity of your workload and activities. *Take charge, and get the best precollege education available to you!* ■

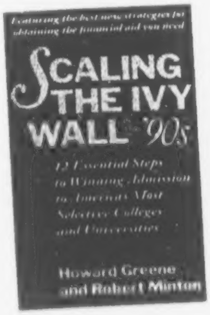
SELECTED RESOURCES

Advanced Placement Program

Request free copies of *A Guide to the Advanced Placement Program* and *AP Bulletin for Students and Parents.* Advanced Placement Program, P.O. Box 6670, Princeton, NJ 08541-6670.

International Baccalaureate

Write or call International Baccalaureate North America, 200 Madison Avenue, New York, NY 10016; (212) 696-4464.


Featuring the best new strategies for obtaining the financial aid you need
SCALING THE IVY WALL '90s
12 Essential Steps to Winning Admission to America's Most Selective Colleges and Universities
Howard Greene and Robert Minton

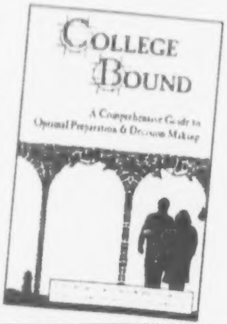
Academic Contests and Competitions

Competitions. F.A. Karnes & T.L. Riley. Prufrock Press, Waco, TX, 1996.

Freed's Guide to Student Contests and Publishing. J.M. Freed. Fountainpen Press, Delaware, Ohio, 1994.

Mathematics Contests. F.O. Flener. National Council of Teachers of Mathematics, 1906 Association Drive, Reston, VA, 1990.

The Complete Handbook of Science Fair Projects. J.B. Bochinski. Wiley, New York, 1996.


COLLEGE BOUND
A Comprehensive Guide to Optimal Preparation & Decision Making

Guides to College Admissions

College Bound: A Comprehensive Guide to Optimal Preparation & Decision Making. 1994. IAAY Publications and Resources, The Johns Hopkins University, 3400 N. Charles Street, Baltimore, MD 21218; (410) 516-0245.

College Planning for Gifted Students, by S.L. Berger. ERIC Clearinghouse on Disabilities and Gifted Education, 1989. The Council for Exceptional Children, 1920 Association Drive, Reston, VA 22091-1589; (703) 264-9474.

Scaling the Ivy Wall in the '90s: 12 Essential Steps to Winning Admission to America's Most Selective Colleges and Universities, by H. Greene and R. Minton. Little, Brown and Company, Boston, 1994.

This author expresses concerns that too many students today take on too much, with troubling consequences. Although ***Imagine*** *encourages our readers to challenge themselves through rigorous coursework and supplemental activities, achieving one's full potential does not require doing everything—or doing anything for the wrong reasons. Keetje originally wrote her thoughts as a letter to* ***Imagine****; we decided that her message was important enough to warrant a full article.*

LIFE IN THE TOO-FAST LANE

by Keetje J. Kuipers

It is Monday night, and I and many others my age across the country stare at our clocks and at our school books. Tomorrow we will rise and begin another day. Once more we will meet the challenges of our honors courses and our soccer teams, our singing clubs and debate competitions, and our violin lessons and student government meetings.

We have a childhood long gone to look back on, one that moved quickly toward adulthood. We have college to look forward to, along with a fast-paced career and possible parenthood.

But are we moving too fast into that future? Do we really wish for our youth to be gone and heavier responsibilities to be at our door? Are we ready now for the pressures of an aggressive, competitive adulthood?

Overwhelmed by Stress

Students, driven by societal pressures, rush for top grades and recognition in an atmosphere where it's almost possible to smell the dank air of ambition and jealousy. Teachers, especially in honors classes, expect us to complete unbelievable amounts of work in minimal amounts of time. Coaches expect us to struggle fiercely to be number one at every meet. Parents expect GPAs of 4.0 and above, as well as high SAT scores.

And as any college-bound young person knows, admissions boards expect to see a substantial extracurricular résumé on each application: community service, student government, sports, and a surplus of other activities are musts.

Do the expectations ever end?

Under great pressure to accomplish the impossible, unable to take time to think deeply about what we read or to enjoy what we do, we focus on the letter grade rather than the material, the winning score rather than the physical pleasure and camaderie of the sport.

Trying to Stretch Time

After expending energy on extracurricular involvement and sports, we still have to deal with hours of academic work. Students in economic need also have to find time for a job. And as always, we are expected to go the extra mile, perhaps practicing an instrument for long hours every day.

Is it even physically possible to live up to all these expectations?

Everyone needs a good night's sleep and healthy, regular meals. But activities cut into mealtimes, and too often we find ourselves eating junk food at odd times of the day. (On Tuesday nights, for example, I consume my dinner—often, fast food—at 7:00 p.m. on my way from piano lessons to a club meeting.) Full schedules often lead to late nights, and too little sleep does not enhance academic success.

Psychological needs exist, too—including the human need just to waste time and have fun. However, not many of us can honor these needs while keeping up with society's expectations.

Rushing . . . Where?

Little is said about how unhealthy this pressure may be and about what changes can and should be made.

Such extreme pressure to succeed may result in loss of enthusiasm, feelings of unhappiness and inadequacy, and bouts of depression. Burnout is common, and in extreme cases, some students even feel driven to suicide.

The real question is, what can we do to change our lives?

We especially need to think more seriously about what kind of college experience we really want. According to Bill Paul, author of *Getting In: Inside the College Admissions Process* (Addison-Wesley), "You don't have to go to Harvard to have a personally rewarding life and career. The point, whether you wind up at Harvard or Cal State Northridge, is to make the most of these four years. Personal success is based more on what you bring to the party [than on] the party [itself]."

We need to examine the reasons we put ourselves under such intense pressure. Are our motives self defined and well thought out, or outwardly focused and uncertain? Are we willing to accept society's emphasis on nearly-unreachable goals? Or should we give more thought to achieving personal satisfaction?

> *Not a day goes by that I don't hear someone mention the stress he or she is under. Recently, a close friend said to me, "What am I going to do? I have only a B+ in MEHAP (Modern European History Advanced Placement), and I haven't slept in weeks because I have so much homework!"*

We must make our concerns known to peers, parents, teachers, and education administrators—we need them to encourage us to seek personal satisfaction over unreachable goals. Instead of spending our last years before adulthood consumed by work and responsibility, we should be able to enjoy the learning process and all the other joys of our high school years. ■

Sixteen-year-old ***Keetje Kuipers*** *lives in Los Altos, California, and attends Mountain View High School. She is looking forward to a career in the opera. When she is not singing, writing, or studying, you may find her at the piano or at a student government meeting. This summer, Keetje hopes to participate in a music program at Interlochen or the University of California: Santa Barbara.*

OVERHEARD AT THE FINALISTS' EXHIBITION

55TH ANNUAL WESTINGHOUSE SCIENCE TALENT SEARCH

by Carol Blackburn

Bruce
Haggerty

"If a historic basalt eruption in Iceland that lasted only eight months could throw 10^7 tons of sulphur dioxide into the air and produce enough aerosol particles to cause Ireland's Great Haze Famine of 1783, just imagine what happened when 100,000 times as much SO_2 poured out over as many years. When the greatest basaltic flows in the earth's history occurred almost 250 million years ago, 95% of the species on earth disappeared in a geologic instant."

"Is that when the dinosaurs became extinct?"

"No, that happened much more recently, at the end of the Cretaceous period."

A scene cut from *Jurassic Park?* No, a conversation between **Bruce Haggerty** (from Stuyvesant High School, New York City) and a younger student who has come to the National Academy of Sciences in Washington, D.C., to see the finalists in the 55th Annual Westinghouse Science Talent Search (STS) present their research projects.

Bruce is one of 40 high school seniors from thirteen states who were chosen as this year's STS finalists out of a pool of 1,869 entrants from all fifty states. His project—*Episodes of Flood-Basalt Volcanism Defined by ^{40}Ar/^{39}Ar Age Distributions: Correlations with Mass Extinctions?*—is the result of nearly four years' work with Professor Michael Rampino of the Earth Science System Department at New York University. Intrigued by a lecture he heard Rampino give four years ago and "in search of a summer job more meaningful than packing groceries," Bruce asked if he could work with Rampino. The geologist said yes.

"What got you started thinking about this—an interest in geology or in evolution?"

"Both. I was fascinated by the relationship between geological activity and important events in evolution."

Bruce's analyses of several mineralogical databases have produced improved estimates of when ancient lava flows occurred and have shown that their occurrences are highly correlated with periods of mass extinction. He has also done research into an alternate explanation of mass extinction events: the impact of comet and asteroid crashes on the earth's atmosphere. Bruce has already published five papers on his findings in peer-reviewed journals.

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Not all STS finalists used the resources of a major university for their projects. **Grace Liu** (from Edison High School, Fresno, California) did most of the research for her project in her own home. Her great-grandfather was a doctor of Chinese medicine, and Grace was curious to see what modern scientific techniques could reveal about the properties of *Astragalus radix*, one of the many herbs in the Chinese pharmacopoeia.

"In traditional Chinese medicine, *A. radix* is used as a 'mental enhancer.' I wondered whether it might be useful to help people with compromised nervous systems. As a preliminary step, I ran experiments to see whether it would enhance the performance of healthy rats in a maze-learning task—and it did."

With that success, Grace felt confident enough to embark upon her project, *Effects of **Astragalus radix** on the Metabolism of **in vitro** Crayfish Ventral Nerve Cords as a Model of Treatment for Neural Injury and Neurodegeneration.* She borrowed equipment to study the effects of *A. radix* extract on the metabolism of isolated nerves, looking at rates of neural conduction, oxygen and glucose consumption, and survival time under metabolic stress. The herb extract significantly enhanced all of these. The final phase of her project was carried out at a nearby U.S. Department of Agriculture lab. ("I don't think they would have loaned me a gas chromatograph; it's a little too expensive," she notes.)

"I haven't purified the active ingredient in the herb yet," Grace explains. "But I hope that further study will show whether *A. radix* could be used to help reduce or perhaps even counteract some of the metabolic deficiencies in neurodegenerative conditions like Alzheimer's disease."

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The impetus for some projects comes from a fascination with the past, be it the evolution of life on Earth or the work of an ancestor. Other project ideas spring from contemporary headlines: **Katherin Slimak** (from West Springfield High School, Springfield, Virginia) completed a project whose title—*Avoidance Behavior and Cholinesterase Activity in Organisms Exposed to Pesticides in Air and Soil Media*—reads like the plot synopsis of an episode of "The X-Files."

Still other projects emerge from the seemingly timeless, abstract realms of human ideation. For years, **Jacob Lurie** (from Montgomery Blair High School, Silver Spring, Maryland) has been fascinated by the esoteric world of theoretical mathematics. His project, *Recursive Surreal Numbers*, involves both surreal numbers and recursion theory.

The system of surreal numbers, devised by the mathematician John Conway, makes it possible to define such strange quantities as the square root of infinity. Recursion theory is concerned with which problems a computer can and cannot do. In his research, which focused on the surreal numbers that can be described by a computer program, Jacob has helped make sense of what it means to add, subtract, multiply, and divide such numbers.

Jacob's mentor, University of Maryland Professor of Computer Science Dr. William Gasarch, looks on as Jacob fields questions from math professors and mystified laypersons.

"It's all his work," Gasarch says with obvious admiration. "There are aspects of his paper that I, as his mentor, do not understand all that well. It's been quite an experience working with him. He's an unusual math prodigy. You expect a math prodigy to be remarkable for his or her cleverness and quickness, but Jacob also has incredible breadth. You don't expect someone so young to be able to accomplish something that requires such an extensive knowledge base."

That thought crosses one's mind more than once while navigating the busy exhibit hall. It's impossible not to be amazed by the dedication and enthusiasm shown by the 1996 STS finalists, and even more, by their ingenuity, intellectual sophistication, and command of the scientific literature. State-of-the-art scientific research **can** be conceived and conducted by some exceptional, surprisingly young students; that is the inspiring message of the Westinghouse Science Talent Search. ■

AND THE WINNERS ARE . . .

rsive Surreal N

The judges agreed with Gasarch's appraisal of the exceptional nature of **Jacob Lurie**'s work. On March 11, 1996, Lurie won the first-place $40,000 college scholarship in the 55th Annual Westinghouse STS.

Second place and a $30,000 scholarship went to **Ting Luo** (from Stuyvesant High School, New York City) for her project, *Identification and Characterization of a Novel Human General Transcription Factor: Implications in Gene Expression Regulation, Transcription-Translation Linkage, Host Cell-Virus Communication, and Programmed Cell Death.*

Matthew Graham (from Stanton College Preparatory High School, Jacksonville, Florida) ranked third and received a $20,000 scholarship for his project, *Prevention of Aircraft Accidents Resulting from Ground Ice Accumulation: Non-Intrusive Ultrasonic Surface Condition Sensor.*

Winners of fourth through sixth place each earned a $15,000 scholarship: (in order) **Bruce Haggerty** (see previous page); **Aaron Einbond** (from Hunter College High School, New York City), *New Proline-Rich Protein-Binding Motif and Prediction of Its Signaling Role in Muscular Dystrophy and Other Genetic Disorders;* and **Daniel Weitz** (from Morristown High School, New Jersey), *Enhancing the Confinement Quality of High-Temperature Plasmas through the Implementation of Intelligent Dynamically Responsive Field Systems: Five-Year Study.*

Seventh- through tenth-place winners each merited a $10,000 scholarship: (in order) **Brian Hafler** (from The Roxbury Latin School, West Roxbury, Massachusetts), *Single Amino Acid Substitution in the Autoantigen Peptide Alters the Cytokine Profile Inducing Protective (Th2) T Cells;* **Simon DeDeo** (from Phillips Exeter Academy, Exeter, New Hampshire), *Distribution of Hydrogen (HI) Clouds in our Galaxy Derived from an Analysis of the Doppler Shift of the 21 cm Transition Line;* **Sidney Chang** (from Half Hollow Hills High School East, Dix Hills, New York), *High Resolution Solid State* ^{19}F *MAS NMR Study of Fluorite-Type Anion Excess Solid Solution* $Pb_{1-x}Zr_xF_2+2_x$ $(0 \le x \le 0.250)$; and **Vezen Wu** (Stanton College Preparatory School, Jacksonville, Florida), *Potent Antibiotics in Carnivorous Plants.*

The remaining thirty finalists each received $1,000 and were treated, along with the top ten winners, to an all-expenses-paid trip to Washington, D.C. Activities included sightseeing tours, meetings with area math and science professionals, multiple interviews with members of the judging panel, two days of public exhibitions of projects, and a concluding awards dinner.

Westinghouse Science Talent Search is the nation's oldest and most prestigious precollege science competition. Applicants must be high school seniors. For more information about the STS or this year's finalists, you may call Science Service at (202) 785-2255 or visit the STS Website:

http://www.westinghouse.com/ca/sci_srch/sci_srch.htm

EXPLORING CAREER OPTIONS: ARCHITECTURE, LANDSCAPE ARCHITECTURE, AND EXHIBIT DESIGN

Interview with The Portico Group

by Carol Blackburn

In this interview, three professionals talk about their work together in a Seattle-based specialized design firm called The Portico Group. ***Chuck Mayes****, an architect and exhibit designer, is one of the founders of The Portico Group.* ***Dennis Meyer****, a landscape architect and exhibit designer, has been at Portico for eight years.* ***Elizabeth Bumpas****, an architect intern and interpretive planner, began working at Portico two years ago, immediately after completing her Master of Architecture degree.*

What does The Portico Group do?

Chuck: Our firm does unusual work. We're a diverse group of about 25 creative people who have gathered together to practice architecture, landscape architecture, exhibit design, and interpretive planning. We work collaboratively—there are no stars. Everyone here is a great resource.

While we do design regular buildings (such as houses and libraries) and sites (such as gardens and parks), what we're really known for is our ability in designing environments and places for informal learning, such as zoos, aquariums, visitors' centers, botanical gardens, and nature centers. Our projects are intended to enrich the public's understanding of and engagement with the natural and urban world around them. We've designed projects from Alaska to New Zealand, for clients ranging from the City of Los Angeles to the National Audubon Society to the Nike Corporation.

What do you do within the organization?

Chuck: As one of the more senior people in the firm, I tend to have a big picture view and be involved in projects in their early stages. I also do a lot of managerial and business-related work such as making proposals and negotiating contracts. In design school, nobody ever tells you that you'll have to do those things!

Elizabeth Bumpas, Chuck Mayes, and Dennis Meyer

Dennis: My role as a project manager and project designer spans quite a range of activities, from talking with prospective clients to concept design to watching projects get built on site.

One of my goals is to involve as many people as possible in the idea generation phase of our work, to encourage a creative synergy. I like creating an open environment in which anyone can contribute ideas without feeling criticized. The design process is like cooking a stew: the mix of ingredients is better than the individual elements. But in design you sometimes get your best product from a pot that boils over: the best ideas often emerge after you've thrown out preconceptions and allowed off-the-wall ideas or oddball thought fragments to inspire others in the group.

Elizabeth: The creative brainstorming is only half the process. The other half is much more technical and detail oriented: fleshing out the big ideas with specific plans, putting together the construction documents. I am more involved in this second half of the process.

Architecture in general, and this firm in particular, appeals to me because you get to use different ways of thinking, different strengths. The neat thing about this work is that there is a wild, creative, brainstorming part followed by an organized, technical period in which the project is brought together. I chose architecture because it's a career in which you can exercise both the right and left halves of your brain.

Chuck: The other aspect of what we do as exhibit designers and interpretive planners is to tell stories. We try to use design and storytelling to make informal educational experiences more meaningful.

Storytelling seems like an unusual activity for an architect. Could you explain what you mean?

Chuck: In the planning stage of an exhibit, we actually write an outline script of what we want visitors to experience, what the main thrust of the message is to be. Those story ideas are then communicated in a number of ways. At the most basic level, captions tell stories about individual displays. At another level, the way we structure an exhibit—the sequence in which visitors encounter its elements—tells a story.

For example, at the Woodland Park Zoo in Seattle, we designed a Tropical Rain Forest Complex which depicts plants and animals in their natural habitats. The exhibit path leads visitors through a sequence of tropical habitats, from an "edge of civilization" biosphere through a secondary forest succession to a primary rainforest. Within the rainforest, the exhibit path moves from the forest floor up through the middle zones of the canopy and eventually out to the top of the vegetation canopy, revealing the complexity of the web of life that is the undisturbed forest.

Each habitat—and even each vertical zone within it—has its own characteristic animal and plant inhabitants, with their stories of life within that world. And by exhibiting the sequence of habitats, we can also show how modern development has affected the native biosphere. The designer and the storyteller in us worked together to create a spectrum of homes for animals and plants that also communicates something about their interrelationships.

Could you describe a project you've especially enjoyed doing?

Chuck: We've recently completed a very exciting project at Oregon State University Hatfield Marine Science Center. The Center has some amazing scientists doing fascinating work. One is using chaos theory to model the learning behavior of sea slugs; another is tracking whales at sea using radio transmitters and satellite uplinks. A third studies life in geothermal vents on the ocean floor, and others are using remote sensing to map environmental changes within the Northwest forests. Our design goal was to help the uninitiated visitor appreciate the complex scientific research being conducted at the Center.

Elizabeth: And the design we created for the Center reflected those people and their interests both explicitly, through interactive exhibits within the Center, and subtly, through design elements—a series of spiral patterns that create a recurrent visual link. The entry drive is laid out on the line of an immense spiral, bringing the visitor to the Center building with its entry courtyard, both of which are also abstracted spiral forms. The spiral evokes images of two realms that are important in the Center's research: nature (a snail's shell) and abstract thought (fractal geometry).

Dennis: What was wonderful about that project was that it gave us the opportunity to take the realm of pure ideas and translate it into three-dimensional site and building designs. The spiral design element reappeared visually and spatially in many manifestations: in paving patterns, in building entryways, even in tree positioning—we laid out the plantings using a chaos theory formula. Its subtle, unifying presence throughout the site is intended to remind visitors that scientists—and the scientist in each of us—are always seeking to find underlying patterns to structure our experience and understand our world.

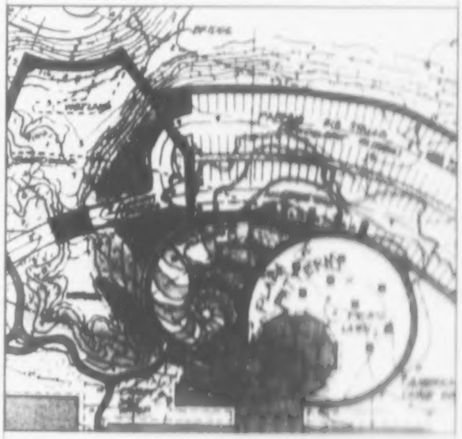
What else do you enjoy about your work? What makes it a good fit for you?

Dennis: One of the best things is that most of our projects are one of a kind, so we are continually facing new challenges and being asked to devise novel solutions. Not doing the same thing over and over again, we have the great benefit of staying fresh mentally; there is a newness with each day, each project.

To me, it's also important that I am doing something consistent with my personal values. I love to draw and design, and I love the fact that, in this work, the outcome of my efforts can be wonderful civic places for learning and fun and celebration. Ultimately, the projects we do are ones with which I am proud to be associated.

Elizabeth: Our work is always challenging. I enjoy the fact that I switch gears a lot, brainstorming or thinking of the big picture one minute and focusing on technical details the next. My days run the gamut from going to the library to research the Alaskan habitat to visiting a blacksmith shop to oversee the fabrication of some metal signs, from sitting at the computer to put in complex details for building structures to playing in PageMaker to put together colorful graphic designs. It's great. You get to suit your tasks to your mood of the day.

Chuck: One of the real benefits of what we do is that we are continuously learning. We work with unusually intelligent, widely experienced client groups, and that forces us to keep up. Also, our work throws us many off-beat challenges. In the Hatfield project, for example, we had to design an octopus tank lid that the inhabitant couldn't open. Not many people in other businesses spend a day trying to out-think an octopus!



Detail of site master plan, Hatfield Marine Science Center; design by The Portico Group

Architecture is an unusual art form; the final product is a function not only of an artist's creative vision but of many kinds of external constraints—laws of physics, city regulations, not to mention clients' wishes and budgets. Could you say something about this aspect of your work?

Chuck: Yes, architecture and landscape architecture span a mushy area between fine arts and functional engineering. Our projects have to be tempered with the realities of human usage and building codes and especially with the program requirements and budgets of our clients. Clients can have tremendous impact—good or bad—on our designs. A key element in our design success then becomes our communication skills, both visual and verbal. We also have to understand the constructibility and cost of our designs because, if we can't get contractors to build them within our client's budget, we can end up with pretty pictures, an unhappy client, and nothing else.

Elizabeth: A designer must turn ideas into physical spaces that work not only for the client, but also with the site, the existing architecture, and other users. For example, at a zoo, the administrators, keepers, visitors, and animals all have very different needs. The designer's role is to tie them all together in a coherent and creative way. Obviously, that can be challenging, but it's part of the satisfaction of designing on such a large and expensive scale.

How did you come to this career field?

Dennis: I was good in math, and my teachers tried to aim me towards accounting, but I knew that wasn't what I wanted to do. In my senior year of high school, I took an interdisciplinary course that emphasized environmental science and land use management. That class and its instructors really piqued my interest and inspired me to study landscape architecture as an undergraduate. From that, I was introduced to drawing and design and went on to complete a degree in fine arts. And I think my current participation in the office really draws upon all those elements.

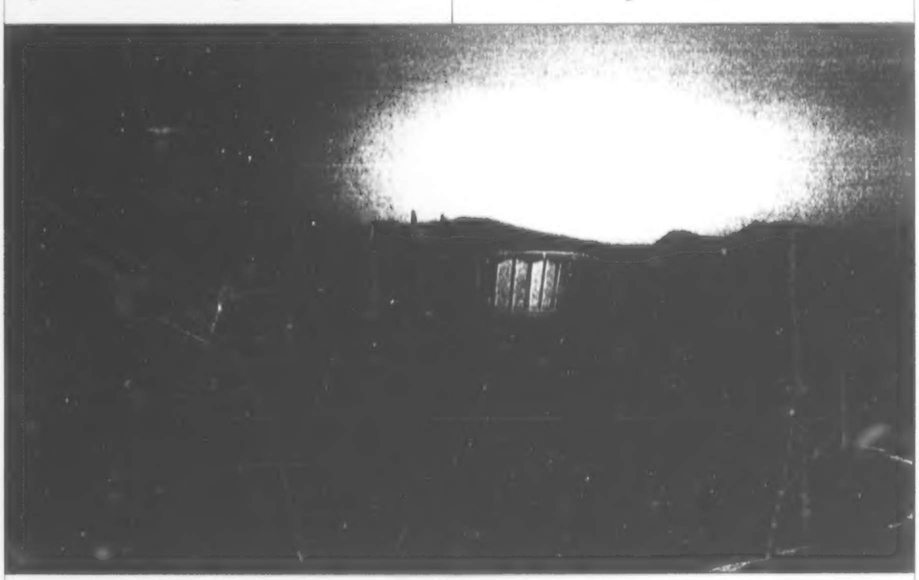
Chuck: From an early age, I was interested in architecture or design in the larger sense. In high school and even in elementary school, I read a lot of science fiction, imagined fantasy places, created dream houses, planned cool imaginary island fortresses . . .

Elizabeth: I used to do that, too!

Chuck: In high school, I decided that I wanted to design and own a ski resort, so I studied geology in college to learn about mountains and snow and glaciers and avalanches. I enjoyed geology and learned a lot of other wonderful stuff: mineralogy, paleontology, stratigraphy. But my discovery, as a senior in college, that the major employers of people with a B.S. in geology were oil and mining companies gave me a strong impetus to search for something else that would better suit my personality.

continued on page 18

So I went back to my earlier love, architecture, and obtained a Bachelor of Architecture (a five-year professional degree). After working in mainstream architects' offices for several years, I was hired by a really innovative firm that was designing zoo exhibits in Seattle and Tacoma. Through those projects, the firm gained national recognition and started getting lots of similar work. While there, I met the four other people who would eventually join together to form The Portico Group. We were all in our thirties and wanted the responsibility of owning and nurturing our own firm. We also figured we were young enough that, if we fell flat on our faces, we could always start over or get a job for someone else. Fortunately, we have been successful and now have gathered a fantastic group of creative people at Portico.



Artist's rendition, Mendenhall Glacier Visitor Center Renovation, Juneau, Alaska; design by The Portico Group

Elizabeth: My career path has jumped around quite a bit. In college, I majored in neuroscience, but as a senior realized that you can't do anything with a B.S. in neuroscience except work as a lab assistant; you need an M.D. or Ph.D. to do all the interesting stuff. So I looked at other options to see if I'd missed "it."

At the time, science seemed a little too dry for me, so I jumped ship and headed for the world of popular science, landing a job in the television department at the National Geographic Society. I had done a lot of photography and graphic arts during college, so my work at NGS drew upon strengths I had already developed. I had a wonderful experience at NGS and loved many things about that job. But ultimately, it turned out to be a little too far in the other direction, a little too "fluffy" for me. I missed the technical, rigorous side of science.

I finally settled on architecture as a field that allows me to be creative—to meet interesting people and do the kinds of fun things I did while working in TV—but that also has a rigorous, technical component—the laws of both physics and municipalities have to be obeyed.

Do you have any other advice for young people on their own paths? Any observations to make with the wisdom of hindsight?

Dennis: It's important to be flexible. For many people, finding the right thing is not a sudden realization, but an evolutionary process, something that gradually dawns on you. When you follow your intuition and see where it leads, various career paths or interests will become evident.

Elizabeth: A common element in all our stories is that we each have wide-ranging backgrounds. And while those backgrounds may not be directly relevant to what we're doing today, I don't think any of us wish we'd started out in architecture from day one because the experiences we've had along the way have added so much to who we are and how we perceive the world. As architects and landscape architects, we're designing places for people to live their lives. If we don't have full lives ourselves, we may end up designing boring places.

Chuck: I think one key is to recognize that a lot of people in this day and age will have more than one career. And there's nothing wrong with that; in fact, in many ways, it's probably something to be desired. When you carry with you insights from a variety of backgrounds and experiences, you have more opportunity to be creative. In many fields, most people may choose to follow well-worn paths. But all sorts of people are working on the peripheries of those paths, synthesizing information from a variety of fields and applying it to the transitional zones between fields. And it's in those peripheral and transitional zones that a lot of creativity occurs.

Dennis: A final hint: Your skills and abilities shine more when you're fascinated. If you can find something that really interests you, you'll not only *be* happier, but you'll do better, more creative work—and it won't feel like work. ■

Suggested Readings

Architecture: the Natural and the Manmade, by Vincent Scully, St. Martin's Press, 1991.

A Sense of Place, A Sense of Time, by J.B. Jackson, Yale University Press, 1994.

Discovering the Vernacular Landscape, by J.B. Jackson, Yale University Press, 1984.

Landscapes: Selected Writings of J.B. Jackson, E.H. Zube (ed.), University of Massachusetts Press, 1970.

The Necessity for Ruins, and Other Topics, by J.B. Jackson, University of Massachusetts Press, 1980.

The Place of Houses, by Charles W. Moore, Gerald Allen, and Donlyn Lyndon, Henry Holt Publishers, 1979.

THE COACH'S CORNER

by Chengde Feng

Mr. Feng teaches mathematics at the Oklahoma School of Science and Mathematics (OSSM) and has coached many students who have competed successfully in mathematics contests in China and the U.S. In this column Mr. Feng offers *Imagine* readers questions designed to improve their problem-solving skills.

1. Given $f(x)=(2x^5-2x^4-x^3-4x^2-x+2)^{1996}$, find $f(\frac{\sqrt{7}+1}{2})$.

2. Given $f(x)$ is a function defined on the set of real numbers satisfying $f(x+2)=\frac{1+f(x)}{1-f(x)}$, (a) show that $f(x)$ is a periodic function, and (b) find $f(1996)$ if $f(2)=\sqrt{3}$.

3. A positive integer is called a *wisdom* if it can be written as a difference of the squares of two natural numbers. Find the 1996th *wisdom*.

4. Let $x_1, x_2, \cdots,$ and x_9 be nine positive integers, such that $x_1 < x_2 < \cdots < x_9$, with sum 220. What is the possible value of $x_9 - x_1$ when $x_1+x_2+x_3+x_4+x_5$ attains its maximum?

5. There are 3n chessmen on a $2n \times 2n$ chessboard, at most one piece in a single square. Show that one can always select n rows and n columns from the chessboard such that the 3n chessmen are in these rows and columns.

MATHEMATICAL PROBLEM SOLVING TECHNIQUES

Off to the Races!

by Alex Saeed

Picture this: It's the last day of the *Imagine* Grand Prix. As one of the finalists, you have high hopes of being one of the winners of this prestigious tournament. As you wait for the signal to begin, you begin to wonder, "What is the worst finish I can get and still win first place?" Fortunately the races go well for you, and you win first place! That night, you begin to think about the other ways the races could have turned out. The Grand Prix is a set of 5 separate courses, with 8 racers in each course. For winning first place in a course, you earn 9 points. Second places earns you 6 points, third is 3 points, and fourth is 1 point. At the end of the five courses, the racer with the most points is declared the winner. Second place is awarded to the racer with the second greatest number of points, and so on. Not acknowledging any tie results, you ask yourself:

What is the worst final score I could get and still finish first? Second? Third? Fourth?

What is the best final score I could get and not finish first? Second? Third? Fourth?

Remember to disregard any tie results, because a tie is not considered a win.

See solutions in May/June issue of *Imagine*.

FASCINATING CLASSICS

FRANKENSTEIN

by Mary Shelley

Review by Lesley Mackay & Kimberly Nolan

Kimberly: I wonder how many of our readers were surprised by Mary Shelley's *Frankenstein.* The novel bears little resemblance to the film and television versions we've all grown up with. Most of us think of Frankenstein as a hideous monster with green skin and bolts sticking out of his neck. But in fact the name belongs to Victor Frankenstein—neither a monster nor a mad scientist, but a young philosopher, a scholar whose zest for learning and desire for glory compel him to create a new living being.

Lesley: The hopeful and hard-working Dr. Frankenstein is quite unlike the hero of the last novel we read in this series, Thomas Hardy's *The Mayor of Casterbridge.* Hardy's mayor allows envy and rage to turn him into a person with a monstrous character. In *Frankenstein,* however, a virtuous hero tries to work a miracle—and inadvertently brings to life a real monster.

Kimberly: And what a monster it is! Victor's creature may be crudely formed, yet he develops a powerful command of language. His speeches are strangely poetic and wonderful. I find him fascinating.

Lesley: Nevertheless, in the second half of Shelley's work, this being embarks on a bitter quest for revenge against his maker. The quest is at times frightening and gory. But Shelley's novel is much more than a horror story. Her personal background can help us to appreciate the serious ideas at work in *Frankenstein.*

Kimberly: Mary Shelley did not grow up in a typical 19th century household. From an early age, she was immersed in the world of writing, politics, and intellectual inquiry. Her father, William Godwin, was a well-known novelist and political reformer; her mother, Mary Wollstonecraft, wrote the famous feminist treatise, *A Vindication of the Rights of Women.* Unfortunately, Mary never knew her mother, who died ten days after she was born, the cause of her death shrouded in mystery.

Mary met her future husband, the great Romantic poet Percy Bysshe Shelley, through his relationship with her family. The two fell in love and eloped when Mary was only 16. They endured many troubles in their life together: their elopement enraged Mary's father, who cut them off; and although it may be hard for us to imagine today, Percy's poetry was largely disregarded during his lifetime, earning him little money. The young Shelleys often depended on their more successful friends, especially on the poet Lord Byron.

Lesley: In fact, the Shelleys were visiting Byron in Switzerland when Mary, aged 19, wrote *Frankenstein.* The work emerged from a contest among friends to see who could come up with the most frightening story. Mary's winning contribution spawned the novel we read today.

Kimberly: Shelley's engrossing story tells of the consequences of a grave human error—an act that is simply too ambitious, reaches too far, and violates important boundaries. On the brink of his "great" experiment, Victor expresses awareness that what he is about to do may be unwise: "I doubted at first whether I should attempt a creation of a being like myself, or one of simpler organisation; but my imagination was too much exalted . . . to permit me to doubt of my ability to give life to an animal as complex and wonderful as man." In spite of his emerging fears, Victor is unable fully to grasp that in harnessing the mystery of life and channeling its forces, he is committing a fatal error.

Lesley: When we contemplate the disaster and despair that ensue from Victor's proud act of creation, it seems strange that Mary Shelley was a deeply creative person married to a wildly imaginative poet whom she adored. Why did she articulate such a dark vision of inspiration and creativity?

Kimberly: I understand your question, Lesley. Shelley's novel may be interpreted as cautioning against ambitious imagination and invention. But I don't think that *Frankenstein* condemns creativity or intellectual drive. Shelley is emphasizing the need to take responsibility for one's work, to be accountable for what one creates.

Lesley: Victor's attempt to fabricate human life is, the novel judges, his first mistake; but he makes a second error that is actually just as serious. He abandons his creation, rejecting it because of its ungainly appearance.

Kimberly: This act of cruelty on Victor's part thrusts the creature out into the world with no preparation and provides him with a motive for revenge.

Lesley: Unable to find sympathy among human beings, the creature avoids despair by embarking on a quest to make Victor miserable. And so Victor finds himself locked in battle with his own creation. But in *Frankenstein,* are man and monster really total opposites? Or can they be interpreted as representing opposing forces within one being?

Let's think for a minute about Beauty and the Beast, Dr. Jekyll and Mr. Hyde, Luke Skywalker and Darth Vader. Many of our most beloved narratives present a pair of opposites enmeshed in some kind of tension or conflict. Prominent critics have presented an interesting theory about the central pair in this novel: Perhaps man and monster are doubles that represent the dual sides of one consciousness, one psyche.

Kimberly: Yes, but . . . although the creature and Victor do appear to be opposites, the two share many qualities. The creature longs for learning just as his creator does and, similarly, educates himself. He is also quite passionate, first in his love for the peasant family he observes and learns from, then in his hate for Victor. By threatening to destroy everyone Victor loves, the monster elicits in Victor his own feelings of isolation and despair.

Lesley: Isolation and human despair are the most important kinds of suffering presented in this novel. Painful feelings of solitude and hopelessness fall not only on Dr. Frankenstein and his monster but also on a third important character, Captain Walton.

In significant ways Captain Walton, too, forms a double with Dr. Frankenstein. Walton, an explorer, is trying to reach the North Pole where he hopes to discover the secret of magnetism. Strangely, he encounters Dr. Frankenstein at sea, attempting to hunt down his creature. It is through Walton that we hear Victor's story.

Walton and Victor have a great deal in common. Both are adventurers who have made their life-choices based on extravagant dreams. And both have stories to tell that make it clear how quests for new knowledge and experience can produce solitude and pain.

Kimberly: I have great sympathy for Victor and Walton, and I admire both characters for their love of knowledge and willingness to take risks to achieve their goals. But each fails to recognize his own limitations and, as a result, puts himself and others at risk.

Lesley: Again, I am struck by what a cautionary tale Mary Shelley produced, despite the intense intellectual excitement that surrounded her. How can we reconcile *Frankenstein* with the highly creative atmosphere in which it was conceived?

Frankenstein builds on Romantic ideas such as the potential for individual glory, adventurousness, and boundless creativity. But while the novel is firmly rooted in the Romantic period, I think that it presents a skeptical view of the Romantic belief in great human possibilities. In fact, the novel seems to warn us that individuals with talents and drives are predisposed to go too far and that, when they do, there is no controlling the outcome.

Kimberly: I'm not sure I agree. I think that *Frankenstein* does raise a red flag about the dangers of unbounded ambition and reckless experimentation, particularly when conducted for selfish reasons, for personal glory rather than for the benefit of humankind. In this way the novel suggests a social philosophy that William Godwin advocated and that is apparent in the lifework of both Percy Bysshe Shelley and Mary Shelley. Godwin felt that human beings are essentially social creatures who should work for the betterment of others. To Godwin, the truly moral person cannot live in solitude.

The solitary work of both Victor and Walton can be seen as dangerous. Blinded by ambition, each loses sight of his responsibility to others and his desire to benefit humankind. Their journeys of discovery force them beyond typical social boundaries and condemn them to lives of loneliness and isolation.

But, despite the dismal fate of *Frankenstein*'s protagonists, the novel also celebrates creativity and the life of the mind. In his early stages of development, Victor's creature possesses an ardent desire for knowledge. He wishes to live with humans beings, to experience the warmth of human companionship. It is only when he is rejected by Victor and recognizes that he is doomed to a life alone that he becomes malevolent. Although Dr. Frankenstein, Captain Walton, and the creature go profoundly astray, they each initially approach their work and their lives with hope and joy.

Lesley: Looked at from your perspective, Kimberly, it seems that Shelley is writing about the human condition, not just about the potential for excess in the Romantic period. Perhaps it is best not to view this novel in relation to any particular era.

Kimberly: The novel does have important historical significance, but I think *Frankenstein* is timeless in its appeal. The characters could belong to any age, and I find Shelley's writing gripping. She is able to convey the urgency of Walton's quest, the intensity of Victor's experiment, and the utter despair of the creature.

Before the creature turns fully against Victor, he confronts and pleads with Victor not to abandon him. The creature's words are moving: "Oh, Frankenstein, be not equitable to every other creature and trample upon me alone, to whom thy justice, and even thy clemency and affection, is most due. Remember, that I am thy creature, I ought to be thy Adam, but I am rather a fallen angel, whom thou drivest from joy." His powerful, poetic language allows me to feel his anguish and sympathize with his condition.

Lesley: I think you've put your finger on one of the great strengths of this novel. Despite its atmosphere of conflict and its mythic, fairy tale quality, it presents no shining heroes and no simple villains. While the creature is physically graceless and becomes bitter and violent, it is also a sympathetic character. Reading this novel, I understand why the creature feels he deserves to be loved: his sorrows are human ones that we can all recognize.

The creature's powerful humanity seems to support an approach to the novel based on the theory of the double. Rather than just presenting man and monster as distinct, opposing forces, Shelley suggests the monstrousness of the man and the humanity of the monster. I think that her book ultimately is strikingly modern. *Frankenstein* anticipates the contemporary emphasis on each individual's dark side and on the inevitable mingling of good and evil.

Kimberly: I agree. The novel's complexity is what has made me return to it many times. In *Frankenstein*, Shelley provides us not with simple answers, but with a brilliant presentation of timeless ethical dilemmas. ■

MARY SHELLEY
FRANKENSTEIN

The final novel in this year's series, to be reviewed in our May/June issue, is J.D. Salinger's **Catcher in the Rye**. Please join us in our encounter with the classic American teenage protagonist, Holden Caulfield.

***Kimberly Nolan** is an Assistant Coordinator of CTY Academic Programs at IAAY. She also teaches literature and women's studies at the University of Baltimore.*

***Lesley Mackay** is IAAY's Staff Writer. She taught literature and composition at Indiana University.*

STUDENTS REVIEW

SWARTHMORE COLLEGE

College Review Series

This on-going series is intended to aid prospective college students in their search by offering insiders' views of selected colleges and universities, as expressed by current undergraduates or recent graduates who have exceptionally high academic ability. Our reviewers all share high expectations for a college's academic standards and its nurturance of emerging talent.

Note that the number of student reviewers is small. Consider their personal perspectives as only one component while you gather factual information and impressions from such other sources as college catalogues, site visits, talks with officials and students on campus, and the advice of your guidance counselor and teachers.

Swarthmore College

Our reviewers include nine students, who major(ed) in economics (1), electrical engineering (1), English literature (2), history (2), math (4), physics (1), and political science (1). (The number of majors exceeds nine because three students have double majors.) Students' comments appear within quotation marks.

Quality of Academic Instruction for Undergraduates

Reviewers praised the faculty and the education Swarthmore delivers. They also noted that there is no grade inflation at Swarthmore.

"Excellent. The quality of instruction is first-rate. With very few exceptions, my professors have been exceptionally good—knowledgeable, enthusiastic, accessible. Almost every Swarthmore student develops a close friendship with at least one of his/her professors. The distribution requirements (three classes each in the social sciences, humanities, and sciences) ensure at least some semblance of a well-rounded liberal arts education. The largest classes—introductory science courses—number about 100 students. Most classes are considerably smaller, with 15-25 standard. The average class size in upper-level courses is probably under ten."

"I have found the instruction to be extremely personal and consistently excellent. Moreover, the professors here are well respected in their individual fields and, on the whole, brilliant and extremely demanding. (Grade inflation has certainly passed Swarthmore by!) In return for demanding a lot of us, they give a great deal; comments on my papers have always been copious as well as extremely insightful."

"Generally excellent. The professors display a love of their subject and an eagerness to share it with undergraduates. Most classes have a significant discussion component, which is what I enjoyed most about my Swarthmore classes. Rather than being lectured to, we were encouraged to grapple with the material, to learn with and from each other. Many upper-level courses are taught as seminars, in which the students have the primary responsibility for presenting materials and leading discussion. Taking that kind of responsibility for one's own education is a terrific learning experience, and the intellectual caliber of Swarthmore students make these classes work extraordinarily well."

"I feel that at Swarthmore I am getting the highest quality education possible. Classes are quite demanding, but help is there if you need it: writing associates to help students with papers, a math clinic, a physics clinic, and departmental tutors. With all these resources, I have rarely felt lost in the shuffle."

"The professors are amazing, and the small classes are intense but usually gratifying. The range of offerings is extensive; most students have difficulty fitting in all they want to learn. The school does not compute class rank or GPA, which creates an environment in which students feel they are working together to learn rather than competing against each other."

"Since there is no graduate school, students carry a major responsibility for the research and publications as well as tutoring. The opportunities for undergraduates willing to seize them are astounding. Grading is tough, though, and not everyone feels that it's worth the struggle."

"Academic resources are very generous: a campus-wide computer network and three libraries with extremely comfortable study areas. Often, though, the libraries are packed with students simply because so many of us spend so much time there."

Social Life

Reviewers were generally happy with the social life, stressing its low-key quality.

"With some 1,300 undergraduates, Swarthmore can be either intimate or claustrophobic, depending on your personality. Meeting people is not hard. The campus is small, and faces quite easily become familiar. Almost all students live on campus, creating a strong community. Dorms facilitate lots of socializing, but not much hard-core partying. There are tons of clubs, from sports teams and musical groups to Amnesty International to the rather wacky Swarthmore Warders of Imaginative Literature (SWIL), who sponsor such activities as an annual pterodactyl hunt."

"The social scene is very laid back and tends to emphasize good friends hanging out together rather than partying. Students often order pizza or Chinese food and just talk. Friendships tend to be very deep, and Swarthmore has been called 'The Quaker Matchbox' because one out of every six alumni/ae is married to another alum."

"To state the obvious, it's what you make of it. There are on-campus movies, plays, concerts, and performances by Swarthmore's teeming multitude of ***a cappella*** *and improv comedy groups. Greek life (two frats and no sororities) plays a very limited role in campus social life. The town of Swarthmore offers little more than pizza and coffee, but with a commuter rail station on campus, the bright lights of Philadelphia are easily accessible."*

"Most students put their first priority on their work (I certainly do!). As a result, social life tends to be low-key. However, Swarthmore offers many social advantages. First, if you come here, chances are that you're pretty similar to the other people here: intense, liberal, and brilliant. (There are certainly exceptions to this, however; I wouldn't dare imply homogeneity amongst the student body.) Moreover, I find the other folks here to be generally amazing, with lots to offer. So, in this sense, it's rather easy to make friends. I find that friendships, like everything else about the school, tend to be very intense and very intimate."

What Do You Like Best about Swarthmore?

Reviewers emphasized the people and the intellectually challenging environment.

"I'm most pleased with the general attitude: a highly intellectual atmosphere, without cut-throat grade grubbing. The feeling of learning for sheer enjoyment is pervasive. Very involved faculty help to encourage this."

"Most of all, I treasure my friendships and how they've enriched me both personally and intellectually. The professors and other students pushed me intellectually farther than I would ever have imagined; they helped me define myself as a person and a thinking human being."

"My fellow students are the highlight of my college experience to date. They are all resolutely multifaceted: the engineering majors play flute and bodhran, the English majors study quantum physics, the religion majors involve themselves in community activism. Swarthmore students seem to refuse niches. They are exceptionally intelligent, ambitious in non-competitive ways, and intellectually and spiritually inquisitive."

"The greatness of any institution ultimately derives from the people who make it up, and Swarthmore is no exception. While in college, I delighted in meeting some of the most talented students and teachers I will ever encounter. My favorite memories are of time spent working together with other students on projects, whether preparing for a seminar or organizing a Valentine's Day computer match-making service."

"One of my favorite things is the Crum woods, meadow, and creek that adjoin the campus. I loved to go for walks or runs there, or just sit on a rock overlooking the creek, thinking and dreaming. It's a beautifully peaceful place, with trails well-maintained by the Scott Arboretum."

"Swarthmore's deliberate egalitarianism—part of its Quaker heritage—is a plus in my eyes. All campus activities are free (well, included in the mandatory activities fee)."

What Do You Like Least about Swarthmore?

The claustrophobia that a small school can engender, the heavy workload, and the emotionally charged political climate were cited.

"Swarthmore's good points at times carry a down side with them. It can be very intimidating to be a student here, because of seemingly god-like professors and amazing other students. Also, its small size and intimacy can become suffocating; you seem always to run into certain people, which can either be wonderful or upsetting. Everyone recommends that people take a semester away from Swarthmore and either go abroad or gain work experience or something. The college encourages and facilitates such semesters away."

SWARTHMORE COLLEGE

Swarthmore, PA 19081
(610) 328-8300

- 4-year private coed college
- Campus in a suburban community 11 miles west of Philadelphia
- Full-time undergraduate enrollment 1995-96: 623 men; 682 women
- Special features: Honors Program, modeled on the independent study system at Oxford. As juniors and seniors, honors students take special seminar classes in their major; at the end of the two years, they must complete comprehensive oral and written exams prepared by outside examiners.

"Swarthmore can be a pressure cooker. Many students have real difficulty maintaining their perspective in the midst of the daily grind. The workload is tremendous; by the end of the semester, it starts to feel like too much of a good thing. Students have to work hard to keep their personal relationships and aspirations intact in the face of the avalanche of work."

"People here usually take themselves way too seriously. The campus is really charged with liberal debates on race, sexual orientation, and gender."

Who Would Be Most Compatible with the Academic and Social Atmosphere at Swarthmore?

Reviewers all agreed that "Swarthmore is a wonderful school, but it is emphatically not for everyone." The profile seems to be "highly intellectual, motivated, politically liberal."

"People either love Swarthmore or they hate it. There's no in-between feeling here. It follows that, if you visit the school and hate it, it's not for you. But if you can see yourself here, chances are you'll love it. In general, intense, academically-oriented, brilliant people tend to flourish here."

"One has to be strongly personally motivated, although not necessarily by grades or rewards, and very curious. I would recommend Swarthmore for students who have already experienced many things—like travel, different environments, different perspectives—because it would seem way too insular here if one weren't aware of the outside world."

If You Had It to Do over Again, Would You Go to Swarthmore?

All reviewers enthusiastically said yes.

"No question about it."

"Absolutely. Even when the workload is at its most insane and I feel like a flattened lump of tofu, I still love this place. The combination of intensely challenging academics and truly amazing people is, in my opinion, unsurpassable."

"In a minute. To learn from caring people, to be surrounded by brilliant colleagues, to be exposed to so many ideas . . . and all on the beautiful grounds tended by the Scott Arboretum. The atmosphere is one of joy in learning."

"There are things I would like to change about Swarthmore, but I don't think any other school has the same combination of highest quality academics, lack of cut-throat competition, and casual social atmosphere. I believe that all of us here have a common bond in that we have never been challenged the way we are challenging ourselves now."

As you try to find the college or university best suited to you, the views of Swarthmore presented above may be helpful. Keep in mind that these students might have had similar positive or negative experiences had they attended a different university. At any college, it is important for the individual student to seek out challenging academic experiences and the best professors, and to create a social life that best fits his or her personal style. ■

Note: The students quoted in the College Review Series are expressing their own views, which are not necessarily those of JHU or IAAY.

CREATIVE MINDS

ImaGiNe...

Submit your creative work—brain teasers, short stories/essays/book reviews. We look forward to hearing from you.
Please write to *Imagine* • SET at IAAY • The Johns Hopkins University • Baltimore, MD 21218

Fascinated by mazes and puzzles, ***Tim Boester*** *is also intrigued by roller coaster design. Tim is a sophomore at the University of Chicago, where he is studying physics and math.*

MATHEMATICAL PROBLEM SOLVING TECHNIQUES: SOLUTIONS TO CRAZY 8S!

by Alexander Saeed

Here we go! A good starting point to this problem is to start making some basic numbers (i.e., 1, 2, 3, 4, etc.) with the fewest number of 8s. For example, the number 1 can be made with two 8s, the number 2 can be made with three 8s, 3 can be made with four 8s, and 4 can also be made with four 8s. This revelation leads to an interesting theory. It should be clear that multiples of 8 should be among the easiest numbers to make. To make numbers between two consecutive multiples of 8, like 8 and 16, you can add 1, 2, 3 or 4 to the lower multiple, or subtract 1, 2, 3 or 4 from the higher multiple. The numbers 1 through 4 can be made with four 8s or less, and because we can make every number between two consecutive multiples of 8 using those four numbers, we are able to make numbers surrounding the multiple of 8, provided we can make the multiple of 8 using four 8s or less. Let's try making the numbers 17, 21, 71, and 73.

Now, 17 and 22 are between two consecutive multiples of 8, specifically 16 and 24. The question we must ask ourselves is whether or not these multiples of 8 can be made with four 8s or less [16 = 8 + 8, 24 = 8 + 8 + 8]. To get 17, we take 16 and add 1. This uses four 8s. Now we must "burn" four more 8s to reach the quota of eight 8s. We can multiply 17 by [(1+1)/(1+1)] to make 17. In this way, we used up four more 8s without changing the answer. To make 22, we choose to use the higher of our multiples of 8, namely 24, and subtract 2. To make 24, we use three 8s, and to make 2 we use three 8s, leaving us with two 8s to "burn." We multiply 22 by [(1/1)] which uses up our last two 8s and does not change the answer.

To make 71 and 73, we use the number 72. We can make 72 using three 8s [(8 x 8) + 8]. Once we have 72, we can subtract 1 to make 71, or we can add 1 to make 73. To make the number 1, we use two 8s. Therefore, to make 71 or 73, we must "burn" three 8s. We can add [(8–8)8] to our desired number, using up three 8s without changing our answer.

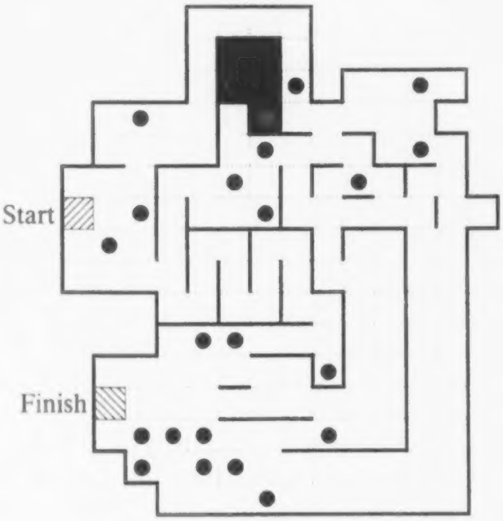
If we can make a particular multiple of 8 with four 8s or less, we can make all the numbers up to four more than the multiple or up to four less than the multiple. What multiples of 8 can we make using four 8s or less? {8, 16, 24, 32, 48, 56, 64, 72, 80} If we can make a multiple of 8 using five 8s or less, we can make numbers up to two more than the multiple or up to two less than the multiple. What multiples are these? {40, 88} Multiples that require six 8s or less allow us to make numbers 1 higher or 1 lower than the multiple. {96} This means we cannot make the following numbers using our strategy: {37, 43, 85, 91, 92, 93, 94, 98, 99, 100}. We must make these numbers using other methods. For example, 37 can be made [(((8 x 8) + 8)/((8 + 8)/8)) + (8/8)]. The solution to the number 100 was included in the previous issue of *Imagine*. Up to now, the numbers 85, 93, and 94 seem impossible. Every other number from 1 to 100 has been solved. How far have you gotten? ■

ANOTHER PUZZLE

by Tim Boester

Directions

Inspired by some byproducts of this year's long, difficult winter, this maze is full of potholes. Moving like a chess knight, find the shortest path from Start to Finish. You must jump around, not through, the walls. You cannot *land on* the squares with potholes (filled circles).



Solution to Tenie Remmel's puzzle in the January/February issue:

Where L=left, R=right, U=up, D=down, and F=fly,

LDRULDR F_3 DDRLRD F_5 LDRULDLRL F_1
LDLLURUL F_2 ULRDULDURD

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IAAY

Spotlight On

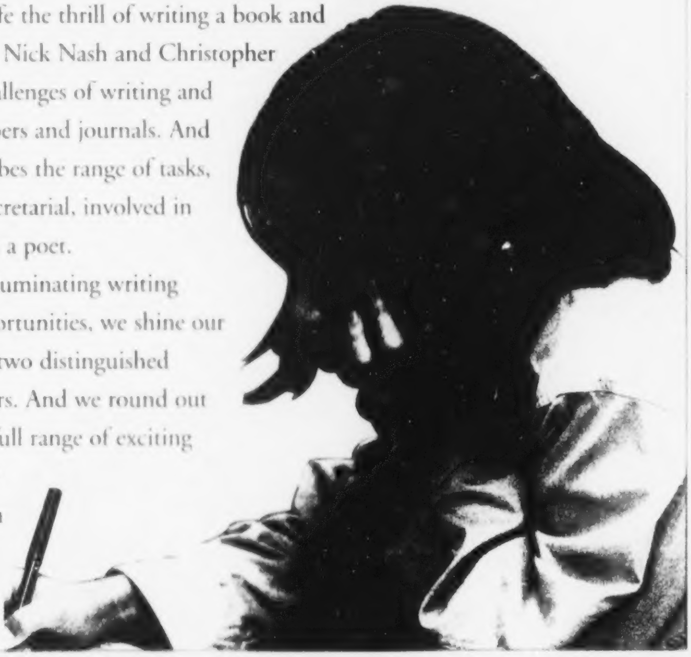
PURSUING WRITING OPPORTUNITIES

The great American poet Walt Whitman once compared himself to a spider throwing out filament. Like spiders, writers produce a thread made from their own substance; and like spiders, writers lob their threads out into the world, hoping that their fine lines will catch, that their writing will be read.

This issue of *Imagine* focuses on the two-part process captured in Whitman's metaphor. We offer insights into the process of writing, itself—the always challenging task of producing paragraphs, poems, news profiles. And we provide information about some of the many forums available to young people who want to collaborate with other writers, see their work published, and continue to develop their writing repertoire and skills.

Writing is both a calling and a craft, and each author has a different story to tell. This issue provides five unique writerly perspectives: Stephanie Davis analyzes a watershed moment when she decided to modify her writing technique. Sara Yamaka brings to life the thrill of writing a book and seeing it published. Nick Nash and Christopher Amar evoke the challenges of writing and editing for newspapers and journals. And A.V. Christie describes the range of tasks, from spiritual to secretarial, involved in pursuing a career as a poet.

In addition to illuminating writing challenges and opportunities, we shine our career spotlight on two distinguished biological researchers. And we round out this issue with the full range of exciting regular features our readers expect. Turn the page—and enjoy! ■



Imagine

1996-1997

Better than Ever!

This issue marks *Imagine*'s third full year of publication. Those of you who have been with us since 1993 have witnessed our evolution from a twelve-page to a twenty-four-page publication brimming with features and facts for talented students.

In 1996-1997 our issues will be more packed than ever with up-to-date information and insights on how you can make your precollege years challenging, fulfilling, and fun.

Here's what a year's subscription will bring to you:

- **Current news about programs, competitions, internships, and other exciting learning opportunities across the country—and articles by student participants**
- **The College Review Series and many feature articles with vital information and insights about planning for college**
- **The Career Series, profiling accomplished professionals in diverse fields**
- **Challenging regular features such as Coach's Corner, Fascinating Classics, puzzles, and much more.**

Focus topics for 1996-1997

- ***Planning Ahead for College***
- ***Investigating the Past through History and Archaeology***
- ***Exploring the Universe through Physics and Astronomy***
- ***Navigating our Global Society***
- ***Utilizing Computers and Technology***

We hope to make *Imagine* even bigger and better in the near future! To do this, we need a larger subscription base. You can assist us—and other students who don't know about us yet—by renewing your subscription on time and recommending *Imagine* to your friends, teachers, counselors, and librarians.

Considering the high cost of precollegiate and collegiate institutions and programs, our subscription cost is minimal. *Imagine* can help you make wise choices all the way up to your freshman year in college—and it can start you thinking about the career world, too.

We look forward to our continued association with you in the fall. Have a great summer!

Imagine...
*Opportunities and Resources for Academically Talented Youth**

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Your Words in Print

by Susan Hellerman

If you're already a published writer, you know that few experiences can compare with the thrill of seeing your work reproduced on the printed page. For one thing, being published means validation of your literary efforts: at least one editor has recognized the value of those thoughts you labored to bring to light, those phrases and sentences you nurtured with such intense concentration and care. For another, being published provides a forum for you to influence readers—to cajole, to convince, to entertain.

If you long to be a published writer, you needn't wait until some magical age of adulthood. Plenty of publishing opportunities exist for students, several of which are detailed by authors in this issue. Consider your school paper or literary journal. (Don't have one? Get some interested friends together and start one.) Encourage your local newspaper to set aside space for editorials or news articles written by and for students. Take a look at literary magazines, and sort out the ones that seem a good fit for your writing style and interests. Pay particular attention to those that solicit only student writing.

Although it's true that your chances of having work accepted are higher with publications that focus on students, don't assume that the adult publishing world is off limits to younger writers—witness Sara Yamaka (page 9), who received a contract after she sent her book to a randomly-chosen publisher without noting her age.

So, let's say you already have some pieces of writing you're proud of. What's needed now is courage. Choose one piece you believe is worthy of publication, introduce it with a good cover letter, and send it out into the world. Don't be discouraged if you're not successful on your first, or fifteenth, try; even well-known writers have papered their walls with rejection notices. Persistence, in writing and in marketing, eventually pays off.

SELECTED PUBLICATIONS OF ORIGINAL STUDENT WRITING

Browse through the stacks of your local library, and check out magazines that publish original work by students only, including these four. ***Important:*** Before sending in your entry, obtain a copy of the submission guidelines by writing to the addresses below and enclosing a stamped, self-addressed, business-sized envelope. Remember to submit your work to just one magazine at a time.

- ***Creative Kids*** (six issues a year) publishes work from students aged 8-14: stories, editorials, poetry, plays, puzzles, cartoons, songs, photographs, artwork, games, and activities. Students receive a free copy when their work appears.
  Submissions Editor, Creative Kids, P.O. Box 8813, Waco, TX 76714-8813; (817) 756-3337.
- ***Merlyn's Pen: The National Magazine of Student Writing*** (four issues a year; middle school edition, grades 6-9, and senior edition, grades 9-12) invites students to submit their writing and art: stories, essays, poems, cartoons, artwork, photographs, plays, puzzles, reviews, and editorials. All writers receive a personalized response within ten weeks. Published authors and artists receive three complimentary copies, plus payment.
  Merlyn's Pen, Inc., Box 1058, East Greenwich, RI 02818-0964; (800) 247-2027.
- ***Stone Soup*** (five issues a year) accepts work from students who are 13 and younger: poems, stories, essays, and illustrations. Published authors and artists receive two complimentary copies and $10.
  Stone Soup Magazine, Children's Art Foundation, P.O. Box 83, Santa Cruz, CA 95063-0083; (800) 447-4569 or (408) 426-5557.
- ***Young Voices Magazine*** (six issues a year) publishes work from students in grades K–12: artwork, poems, essays, stories, photographs, and book reviews. Those whose work is published receive a complimentary copy and monetary award.
  Young Voices Magazine, P.O. Box 2321, Olympia, WA 98507; (360) 357-4683.

ALSO CONSIDER:

- ***Apprentice Writer*** (once a year), distributed to high schools and colleges throughout the Middle Atlantic states, accepts written work and photography/graphics from students in grades 9-12. The submission deadline is March 15.
  Gary Fincke, Writing Program Director, Susquehanna University, Selinsgrove, PA 17870-1001; (717) 372-4164; e-mail: fincke@susqu.edu
- ***The Concord Review: A Quarterly Review of Essays by Students of History*** (four times a year) publishes papers on historical topics of national and international interest written by students in grades 9-12. Essays must reflect careful research and high standards of scholarship, use primary sources when possible, and include thoughtful in-depth discussion. Papers should be about four thousand words long and have endnotes, and must be printed from a word processor or submitted on a Macintosh disk.

  The Concord Review also sponsors the **Emerson Prize in History,** awarded in a public ceremony to two writers of previously published essays.
  Will Fitzhugh, Editor, The Concord Review, P.O. Box 661, Concord, MA 01742; (508) 443-0022.

Continued on page 4

SELECTED STUDENT WRITING COMPETITIONS

Writing competitions offer another level of challenge to aspiring authors. Whether the competition involves an essay on a prescribed topic or a review of your writing portfolio, the winners' rewards—both in monetary prizes and in public attention paid to your work—can be significant.

Be sure to obtain submission guidelines before submitting your work. Only entries that conform to guidelines will be considered.

- **ARTS (Arts Recognition and Talent Search)/ Presidential Scholars in the Arts**
  Grade 12

Sponsored by the National Foundation for Advancement in the Arts, the ARTS program recognizes students' achievements in creative disciplines, including writing. Applicants may enter portfolios in one or more category: poetry, short story/fiction, play or script for film or TV, section from a novel, and expository writing/nonfiction.

Four levels of cash awards (from $100 to $3,000) are given within each arts discipline, and all ARTS applicants are eligible for college scholarships in the creative and performing arts. Selected awardees are nominated for consideration as Presidential Scholars in the Arts; twenty are chosen each spring and honored during an all-expenses-paid week in Washington, D.C.

Postmark deadline: June 1 (early; lower fee) or October 1, 1996

For registration forms: NFAA/ARTS, 800 Brickell Avenue, Suite 500, Miami, FL 33131; (800) 970-ARTS or (305) 377-1148, fax (305) 377-1149; e-mail: NFAA@ARTBANK.COM

- **National Council of Teachers of English Achievement Awards in Writing**
  Grade 11

High school English departments in the U.S. and Canada, as well as American schools abroad, nominate excellent writers who will graduate the following year. In April, students submit two pieces of original writing: an impromptu essay and a sample of their best writing—a poem or short story. Awards are announced in October.

NCTE also offers the Promising Young Writers Program, for students in grade 8.

Nominations deadline: January 23, 1997

National Council of Teachers of English, 1111 W. Kenyon Road, Urbana, IL 61801-1096; (217) 328-3870.

- **National Federation of Press Women High School Journalism Contest**
  Grades 9-12

State contest winners' entries are evaluated for excellent journalistic work published since last year's deadline: editorials, feature stories, news stories, sports stories, personal columns, feature photos, cartooning, and graphics. Selected student work appears in national journalism publications, and winners in each category receive cash prizes (from $50 to $250).

State contest deadlines: Vary, in fall. Request the name of your state coordinator.

National contest deadline: February 1997

National Federation of Press Women Headquarters Office, 4510 West 89th Street, Suite 110, Prairie Village, KS 66207; (913) 341- 0165.

- **National Peace Essay Contest**
  Grades 9-12

The United States Institute of Peace sponsors this annual contest to promote public education and discourse on the complexities of international conflict and peacemaking. A local contest coordinator acts as liaison between students and the Institute. Following established guidelines, each student submits a 1,500-word essay on the assigned current events topic, along with bibliography/endnotes of reviewed sources.

Winners receive college scholarships: at state-level, $250-$750; at national level, $3,500-$10,000. State-level winners are invited to Washington, D.C., for a week-long program.

Postmark deadline: end of January 1997

The National Peace Essay Contest, United States Institute of Peace, 1550 M Street, N.W., Suite 700, Washington, DC 20005-1708; (202) 429-3846, fax (202) 429-6063.

- **National Written and Illustrated By... Awards Contest for Students**
  Ages 6-9, 10-13, 14-19

Entrants submit an original book of 16-24 pages they have both written and illustrated. One winner in each age category receives a publishing contract from Landmark Editions, works with professional editors and art directors to prepare for publication, and is paid royalties on sales.

Entry deadline: May 1, 1997

For guidelines, send a self-addressed business-sized envelope stamped with $.64 in postage: NWIB Awards Contest, Landmark Editions, P.O. Box 270169, Kansas City, MO 64127; (816) 241-4919.

- **Quill & Scroll Society International Writing and Photo Contest**
  Grades 7-12

Students compete individually by submitting entries published since last year's deadline in a school, local, or national newspaper: editorials, cartoons, news stories, feature stories, sports stories, photography.

First place sweepstakes winners in each category receive a National Award Gold Key and plaque or mounted certificate; winners at high school level also receive a Smith Corona typewriter and are eligible for one of ten scholarships.

Entry deadline: February 5, 1997

Quill & Scroll Society International Writing and Photography Contest, School of Journalism and Mass Communication, The University of Iowa, Iowa City, IA 52242-1528; (319) 335-5795.

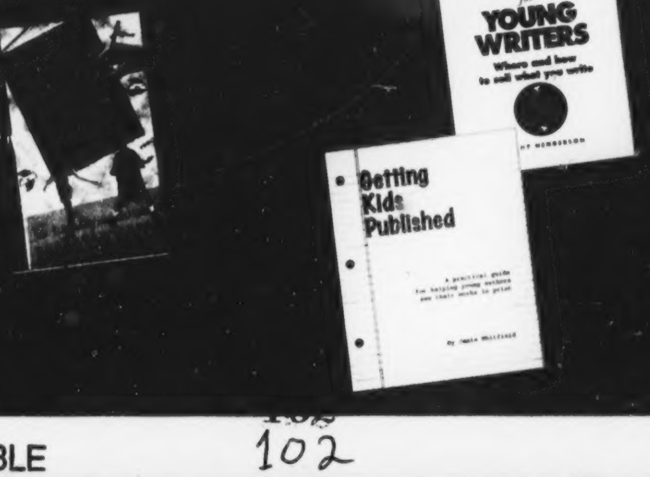
- **The Scholastic Writing Awards**
  Grades 7-9, 10-12

The Scholastic Writing Awards program operates at both the local and national level; regional finalist entries are forwarded to New York for national judging: short story, essay/nonfiction/opinion writing, dramatic script, poetry, humor, science fiction/fantasy, and writing portfolio. Entries are considered for Gold and Silver Awards, publication opportunities, and scholarships.

Deadline: Varies by geographical region; inquire in fall.

The Scholastic Writing Awards, Alliance for Young Artists and Writers, Inc., 555 Broadway, Fourth Floor, New York, NY 10012; (212) 343-6892.

Suggested Resources


MARKET GUIDE for YOUNG WRITERS
Where and how to sell what you write
Getting Kids Published

Once, this author believed that writing came from the heart, couldn't be taught, and was based solely on talent. Then she took a writing class.

The Talent Trap

by Stephanie Davis

I resented the concept of a writing course from the first moment I heard about it. Writing has been, for me, the subject of an enormous amount of thought and philosophizing; I used my interest in fiction as an excuse to make grand pronouncements to the "uninformed" about what a Writer does and does not do. I think—and hope—it was less an expression of egotism than an overflow of enthusiasm, a need to advance my commitment to the activity I loved most by extending my authority.

I had enjoyed enough success to believe realistically that I had some potential, having published in *Merlyn's Pen*, Fairfax County's *Fragments*, and my high school's magazine, *Threshold*. Those same successes also let me convince myself I was doing everything perfectly; I was talented enough to avoid the criticism I needed most. By fifteen I had developed an attitude based on passionate inexperience: Writing comes from the heart; it can't be taught; and it's the only profession in the world based solely on inborn ability.

So in the summer after sophomore year I paged through the CTY course catalogue—it was my last year of eligibility—and looked most seriously at the science courses. My family finally persuaded me to try the fiction, if only to dedicate myself to three weeks of nonstop writing. I don't honestly believe I began those weeks with an attitude of smug superiority; it was more of a hope that the teacher would excavate something profound I'd never worked at in my writing and then tell me what I wanted to hear. I showed him a few of my fiction pieces and waited for compliments.

He nodded a couple of times and then looked up at me. "Uh-huh. You tell us just about everything. Now try showing us. See if you can get all these feelings across without plastering them all over the page."

It wasn't, of course, literally the first time I had taken criticism. It was only the first time I had heard it without any glimmer of amazement mixed in, without some preface involving praise that negated problems. I nodded and smiled and took his thoughts back to the dorm to steam over for the weekend. I had shown him some of the best work of my talent, the strongest writing I had in me, and he had treated it like an exercise: you tried that, now try this. It was a finished work, and he had attacked it at its deepest core—the way I was telling it.

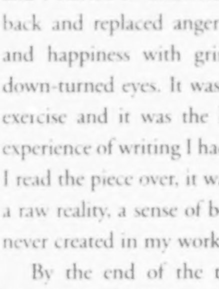
By Sunday afternoon I was surprised by my own anger. I tried to understand it because that was one of the things I felt, and feel, a writer's duty involves. I looked over the piece and saw what he was saying and realized I had heard similar things before—only never without a wash of compliments. That shook me. What right did I have to anger? Was I only capable of dealing with wholesale approval? I had never honestly believed my work was perfect, but did I hunger to feel that everyone else did? It was a painful reflection: when had I begun to think I had the right to everyone's near-unconditional approval?

It was then that I began thinking about the whole business of writing. It had always been an autopilot process for me, sitting down and rolling my sleeves up and pounding out whatever came to mind. I said what I thought, and my sense of rhythm and flow was sufficient to ensure that I communicated without conscious effort. Only then did I realize that, for all the time and talk that went into my craft, I had never worked at writing. It came well and easily; my roommate was sweating over perfect phrases, while I glibly set down good ones. And here, for the first time, I was being asked really to labor—only to find myself in the grip of a curious laziness.

I had built my philosophy on the conviction that sheer talent gave quality, that training meant little because writing was the expression of self, not lessons learned. The act of thinking and planning necessarily negated that conviction: if good fiction took thought and experience, then it took training. For the first time in my life, the concept of a writing course made sense to me. It opened wonderful, terrifying possibilities; not only did I not know everything about writing, but there could be dimensions and techniques to it that I had never imagined. All it took was the acknowledgment that writing could be learned and taught, and the willingness—and humility—to try learning it.

I spent Sunday night hunched over my story, working my pencil with a frantic energy, as if I was afraid whatever I had caught would slip away. At midnight my roommate begged me to turn off the light, and I took a flashlight under the covers. I methodically removed every "feeling" word, every character's thought, stripping the story bare. I read through the "show, not tell" story example my teacher had given us and I started to understand. And then I went back and replaced anger with clenched jaws, and happiness with grins, and shame with down-turned eyes. It was almost a mechanical exercise and it was the hardest, most boring experience of writing I had ever had. And when I read the piece over, it was rougher. But it had a raw reality, a sense of being there, that I had never created in my work before.

By the end of the three weeks, we had blown the lid off everything I believed. I had seen my "potential" as a solid ceiling: my ambition had been not to improve but to write more. Suddenly I had a tiny taste of the incredible possibilities, the depth and humor and power of trained and talented writing. It left me with a painfully clear perspective on my earlier work and a bittersweet sense of how much further I could go. ■



Stephanie Davis *is a senior at Thomas Jefferson High School in Virginia. This fall, she will attend Princeton University, where she plans to major in anthropology.*

Poets, like other artists, must replace indifference with attention. A.V. Christie describes heightened sensitivity to the world as the basis for her work as a poet.

The Poet as Scavenger, Alchemist, and Agent

by A.V. Christie

Bright seagulls wheel past me on the balcony of my hotel room in Ocean City, Maryland. Here for the week as part of the Artists-in-Education program sponsored by the National Endowment for the Arts, I'll be working on poems with eighth and eleventh graders in a neighboring town. With the ocean's huge sound in the background, I sift through my commonplace book—an album of quotes and clippings—thinking about my life as a poet, how I write poems, and what I have done to spur, nurture, and protect my progress as a writer.

I turn the page and find: "In Australia's outback during the hot weather, sheep line up in single file in the narrow shade of telegraph poles." What a strange and outlandish image! But facts just like this are the perfect place to start. I came across these sheep in the 'Grab Bag' column of the *San Francisco Chronicle* fifteen years ago; in the same issue, I discovered another odd description: in England's Camborne caves, miners brew their tea with water tapped from the caves' piping hot walls. I clipped them both. Such slight details steep in the mind for years, awaiting their proper place in one's writing.

What exactly do a poet's years look like? What does a poet do when not writing poems? For many poets, this is much of the time, since creativity does not take place at a Henry Ford-like, assembly-line pace.

As Guy Davenport once said, "Art is always the replacement of indifference with attention." And much of my year is spent in earnest observation of my surroundings. What rich and enticing forms this information takes! I go to the symphony, to Venice; following various obsessions, I seek out van Gogh's sketchbook or study *feng shui.*

I see my writerly life as equal parts epiphany, frustration, and courageous obstinacy. There's ambition like a dance chart on the floor, dictating my next step, pointing the way. But, too, there are the many small, unlikely things throughout the years that have shaped me into a poet.

The memoirist Patricia Hampl uses the word scavenger to describe the writer searching. A scavenger feels much like what I am, what I spend my days doing, gathering the thoughts and materials that will at some critical point take shape together in the form of the poem. "Only connect," wrote E.M. Forster, and the mental work and inspiration, the alchemy of connecting, are what my hours go toward. Why does the man in the rain with his bag of cutlery in one hand and a trumpet under his arm belong in the same poem with Baron Vrangel's garden of living statues? I see the faint beginnings of a poem charting the idea of extremity. Exploring exact connections will bring this poem about.

While the creative mind revels in its liberty of brocade or saffron, there is also a part of the poet that plays the role of secretary and literary agent. The duties falling to this half-personality are writing query letters, keeping careful track of which poems have been sent where, and licking stamps for self-addressed envelopes. This, obviously, is the less glamorous side of being a writer.

In the ten years since college, my approach to these mundane obligations has grown less haphazard. In the library's periodical room, I've reached high, identifying the twenty best, most-read journals currently publishing poems. And this is where I send my work, over and over, willing to trade quantity—frequency of publication—for quality. Put my work with the finest work, I say, printing out envelopes. A few poems rejected at *Poetry* are sent out again to *The Iowa Review*. Every poem I consider finished is out, then, for some editor to see.

Having most of my manuscript's poems published in this way gives the entire work a stamp of approval when I enter it in book competitions. I enter perhaps ten competitions each year—The Walt Whitman Prize, for example—often feeling like a baseball player trying to make it to the major leagues. The numbers are daunting and on bad days the odds seem impossible: 1,000 manuscripts vie in each contest to become the single book published as winner, a high-profile honor that can launch and cement a poetic career.

Everything I try for, even in the shadows of unlikely numbers, I try for because I think my work is strong enough to take the next step. Friends and mentors have helped also by nominating my work for prizes. And so connections are important—a little handshaking. But confidence as well, the brash chutzpah to say: Yes, I should be an NEA Artist-in-Education; yes, I should be awarded a month at an artist's colony. Ego in some measure is essential.

And modesty and patience. As yet, I've been only a finalist in book prizes: the bridesmaid carefully positioned, reaching for the bouquet. And I've not yet had a single poem in *The New Yorker*, 'yet' being the operative word. I can't count the crossroads when I've thought it would be easier not to be a writer, those weeks when almost a rejection letter a day arrived through the mailslot. The world had decided I had nothing worthwhile to say. And I decided again not to believe the world.

I remember Mrs. Strickler, my eighth-grade English teacher, who helped the class make and bind books. To fill the blank pages of a book and have the words and thoughts be something I could then hold in my hands—to me, this felt like something I could do for a long time. And then piano lessons, reading Emily Dickinson my freshman year in college, postcards from my brother in the Galapagos—all somehow part of the process. My gift has been to attend to these moments and the strange facts of the world around me, to preside as they reveal their meaning.

A. V. Christie teaches literature and writing courses at Goucher College. Her manuscript **Nine Skies** *was a finalist last year in The Yale Series of Younger Poets Prize.*

Now, on the very brink of summer when most magazines take a reading hiatus and most book contests have ended, I can step out of my three-piece business suit—so confining—and go back to the heady ambiguity of writing poems. I'll be working on the large, unruly group I've recently written, polishing them and making them speak to one another in that mysterious structuring of a second manuscript. *Proof*, I'm thinking of calling it because the word suggests validity, the process of truth. Or, as with alcohol, potency and strength. ■

Two Poems

ORNAMENTAL

When birds, sharp in the new air,
catch like hooks in my breath;
when each crocus, whetted
and golden, pierces the ground,
I know it is spring again.
Lucky, those who love what returns:
crocuses, vivid and ever-burgeoning;
the delicate and recognizable birdsong
which gluts the shallow morning.

—A. V. Christie

Photo by John Fattibene

COME FALL

When the fireflies go dim, lights at the track
come on and in the early dark
the hills are glowing.

Lurid, otherworldly, the dry grasses and thistle.
And there will be a football game at the high school
and a homecoming
after weeks of crepe paper budding in their hands,
on a float's slow turn around the field.
And the batons going up into the night
will make of the light something
that falls again and again.

—A. V. Christie

Working on a high school newspaper involves interviewing, writing, editing, and of course lots of detail work. The rewards, according to these authors—having a voice in the community, tracking down exciting stories, seeing one's words printed on the page.

N ISSUE IN THE LIFE OF THE HOPKINS *RAZOR*

by Elisa Beller and Nick Nash, with reporting by Cara Gitlin and Lauren Pistell

What requires 128 pages, about 350 photographs, 120 megabytes of data, 150 slices of pizza, about 900 hours of computer time, and an estimated 270,000 mouse clicks?

The secret marketing plan for Windows 95? No.
A year of work on *The Razor*? You've got it.

Students at the Hopkins School reading *The Razor* moments after distribution.

Photo by Charles Weiss

ne out of every ten students at the Hopkins School in New Haven, Connecticut, works on our school newspaper, *The Razor.* With sixty people aboard, *The Razor* often resembles a small corporation rather than an amateur student publication. It's one of the most demanding extracurricular activities on campus—editors expect to invest up to ten hours a week (how else to fit in those 270,000 mouse clicks?)—yet we love the work. Why?

Perhaps it's each student's desire to have a voice in our dynamic, but isolated, community on the outskirts of the city; perhaps it's the thrill of stalking the elusive lead until the hot story erupts; or perhaps it's the joy of publishing our thoughts on the printed page.

Under the guidance of our 17-year-veteran faculty advisor, Mrs. Susan Feinberg, we produce a new issue each month. *The New York Times* we aren't, but we strive to maintain high journalistic standards while informing and entertaining the student body through objective news, lively sports coverage, feature stories, investigative "special reports," and thoughtful editorials.

Along the way, we develop vital skills: negotiation, communication, organization, judgment.

This past November, we celebrated the paper's 50th anniversary by attempting—and accomplishing—something we had never done before: a commemorative issue with full-color photographs. Color represented a quantum leap for *The Razor,* largely due to its exorbitant price: at $1,200 for 20 pages, this edition was about three times more expensive than a conventional issue.

Not surprisingly, negotiating funding for the color issue was quite a challenge. We had two lucky breaks. First, a staff photographer's father who owns a printing company offered to "separate" the photographs into primary colors without charge. Second, we convinced the school's alumni office to purchase an extra 5,000 copies of the issue to mail to graduates and their parents; since it was quite inexpensive to print more copies once the printing press was set for color, our per-copy cost dropped by 50%.

Planning for the issue began six months before November. A primary goal was to intersperse articles culled from old issues with current news. Thus, a contemporary story on early applications to college found itself next to a 1961 interview of visiting author Thornton Wilder. ("We had expected to find such a well-known writer a little cold and not a little condescending," noted the reporter. "Instead, we discovered a warm, amiable individual whose first words were, 'May I take your coat?'")

Integrating these extra articles dating back to 1945 proved the most demanding aspect of producing the issue. In June, teams began searching through every old issue; they compiled a list of possible articles that could prove interesting to today's audience. By October, section editors had decided which historic articles to run and had devised creative layouts weaving old and new on the computer screen.

The biggest challenge was scanning (digitizing) the old articles into the computer. Previous issues are archived in two-foot-long hard cover books, so getting the right article aligned with the notebook-paper-sized scanner was, to say the least, time consuming. Our production manager had to spend 20 hours in front of the computer during the final layout weekend.

A special five-page section dealing with the paper's history, including retrospectives by former editors and faculty advisors, was the centerpiece of the issue. As interesting as the evolution of the paper from a single sheet are the

Continued on page 11

What's it like to write a book that gets chosen and produced by a major publishing house? This author traces the journey of her work, **The Gift of Driscoll Lipscomb.**

DESTINATION: Publication

by Sara Yamaka

***The Gift of Driscoll Lipscomb* describes a young girl's coming of age under the guidance of a wise mentor. Driscoll Lipscomb encourages Molly to develop her visual appreciation of the world around her, to perceive its richness through revering the full array of its colors.**

My mother brought me a thin letter from the publishing company when she came to collect me from school. It was tenth grade, and I was standing with a friend on a curb when I opened the envelope. Inside was a typewritten letter from one of the editors expressing her wish to publish my story, *The Gift of Driscoll Lipscomb*, as a children's picture book. Late in the spring of my eleventh grade year, *Driscoll* was released by Simon and Schuster Books for Young Readers. The entire experience has been surprising, sometimes uncomfortable, and more than a little fun.

I've always loved reading and writing; language holds a fascination for me in its intricacy and power. So throughout school and in my spare time, I turned out stories, poems, and sketches—pieces that I held mostly as entertainments, not to be agonized over, but to be savored. I wrote my book on a lazy summer night. It took a couple of hours to lay out the story and then a bit more time to proofread it with my mother.

The only difference between *Driscoll* and my usual scribbled fictions was that a few days later I decided to package this one off to a publishing house. Finding a name and address in the back of a "How-To" book, I followed the instructions for form and size and mailed my little story away without revealing my age to the publishers. I expected eventually to be awarded a rejection notice. Instead, I was thrilled to receive an acceptance letter that would lead me to become a player in the world of editing and producing books.

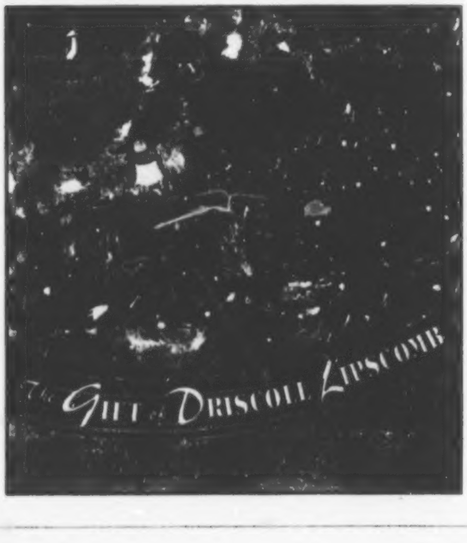
Fortunately, Simon and Schuster regarded and respected my opinion even after they discovered my age. They assigned me a young editor, Andrea Schneeman; she and I worked together on my story for about two years before it was ready for publication. Actually, not much was done to alter the original story, but even seemingly minute points are considered when a book is published, so changes involving *ands* and *thes* were thoroughly discussed.

I wrote my story when I was fourteen and collaborated on the majority of the editing when I was fifteen and sixteen. I'm seventeen now. It's funny to read my book and remember what I was like three years ago. I'm sure I wouldn't (maybe couldn't) write the same story again; for me, the tale is pretty well frozen in time. It's a published work: I can't get it back and change it around, so I have to live with the decisions I made as a younger person. I like the book now, but it was clearly written by a different person.

For this reason, it's sometimes difficult to answer the questions I'm asked about the writing or my original thoughts. I have remained a thinking, producing, creative person, but the facet of me that is publicly available is the product of a fourteen-year-old kid whom I have trouble remembering.

Sometimes, it is still hard for me to imagine strangers, people who don't actually know me, buying *Driscoll*. It is a peculiar thing to create something out of words and ideas that is then bought and sold on the market and read and seen by people you will never see or know. It is also very satisfying and sometimes slightly thrilling.

I'm sure that the experience of working in the greater world and the privilege of having my work professionally produced will stay with me and serve me well as I move out into that world as an adult. The period forever linked in my mind with the publication of my book has been an exciting time, a time that has forced me to become comfortable with a public self. Four years ago I had no idea that sending away my story would lead to interviews and speeches, articles and signings, but I'm glad that I did it. I hope that my life is filled with myriad events as fun and stimulating. ■


The GIFT of DRISCOLL LIPSCOMB

"So I went to hillsides and stream banks at dawn and dusk and noon to paint. At dawn the red was russet and the yellow burning hot, and the violet lay delicate and wistful. At dusk a misty gray seeped into blue, and the orange deepened into pumpkin color. At noon the brilliance of the blue and the cleanness of the green were lighted by a clear, strong orange-yellow.

And I took my paints, my gift, and I worked."

***Sara Yamaka** is a senior at the Park School in Baltimore. This fall, she will attend Goucher College where she plans to pursue intercultural and international studies.*

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A SUMMER AT *SPARE CHANGE*

by Christopher Amar

Written words can build bridges of understanding between different communities. This author describes a summer working as an editorial intern.

I had never had a conversation with a homeless person. I had little faith in my ability to write, and even less in my editing skills. Yet on a warm day in May, I was standing outside the Old Baptist Church which lurks like a thundercloud over a corner of Harvard Square, trying to picture Mark Goldfinger in my mind. I felt comfortable merely standing there for a second because I was hesitant. I hoped to avoid a summer of rigid hours and a monotonous rhythm. And I wanted to assist people in need. But I also feared that my succor, however insignificant it might be, would be rejected as being given from behind a veil of condescension.

Mr. Goldfinger, the editor of *Spare Change*, a newspaper produced by the homeless, worked behind the entrance in front of which I hesitated. The Old Baptist Church back door was black and covered with ivy, and it did not look as though it would move. When it did, I saw that it opened onto a great hall of uneven floors and stained glass windows which admitted a pale light. From the corner of the hall, a stronger yellow line of light broke from under a door. I went to the door; behind it lay, I hoped, two months of work and experiences.

I decided to give up thinking of an introduction because I knew that the gush of light and aura of new surroundings would wash away all my thoughts. This, I would soon see, was a wise decision. Mr. Goldfinger scorned a false boldness just as he scorned a false timidity, the two ways in which I most often confront the unfamiliar. I coolly told him my name, my purpose, and my experience, while he took off his glasses and stared, squinting, at me. His beard was gray and gray his face, his eyes round and deep, his beaked nose prominent enough not to blend into the heath of hair and lines. He was a wise-looking owl, which is why I was shocked when he agreed to let me work there for the summer as an editorial intern.

A
DAY'S
WORK
WANTED

Photo by Christopher Amar

The mission of *Spare Change* is to show by its example that homeless people can create change for themselves, given the proper resources. Its monthly circulation of 30,000 is due mostly to the efforts of its vendors, who are either homeless or otherwise economically disadvantaged. The vendors buy the monthly issues for twenty-five cents from the main office. They then sell each for one dollar at the street corners. Most of the vendors, who are predominantly male, can slowly become financially independent by this process.

The office was smaller than I had imagined. There was room for four desks and three computers. My desk was on a platform in the corner of the room, accessible only by an uncertain staircase.

I expected to ease my way into my job, but Mr. Goldfinger immediately put me to work. I began by copying articles written by homeless men and women into the newspaper's database. Soon after, Mr. Goldfinger gave me some of his own articles to read. His asking for my thoughts was a touching gesture, especially because I was new.

After a week in the office, I had discovered the soft shield of routine. Each morning I greeted all of the office workers, breathed in the scent of old newspapers and dying machinery, and settled onto my perch. Unsuspected and maybe even forgotten, I would often hide behind the clutter of paper in order to watch the faces. They were worn but most had a glimmer of dignity or optimism or something from within that prevented them from denying life; few of the faces were jaded.

For nine weeks, Mr. Goldfinger handed me stories which I edited and then retyped. They ranged from an anecdote about life in the Black Panther movement to an interview with Tipper Gore. Sometimes I received poetry, which I never felt comfortable editing.

The poets themselves were just as hesitant about having someone else change their words, so they usually sat down with me as I read their work aloud. Their writing was the medium through which my work became personally fulfilling: often I had merely to pose a probing question and their memories flooded forth into their thoughts and out into the air. It made no difference who grasped the words just as long as someone caught them, but I listened well and they, I think, saw that. I was not sure after a while whether I was more effective as an editor or as a retainer of stories. As my stay approached the end, I began to wonder if I had given anything worthwhile in return for the many lifetimes' worth of stories.

I met a husband torn from his life by drugs and trying to find his children. I met a man who had drifted from prison to prison looking for an anchor. When they told me their stories, they were not pessimistic or detached, but instead persevering. They had a cool and reserved outlook on the future.

When the leaves began to fall and my town paper once again spoke of the high school football team's chances of winning the league title, I tried to identify some truth that my stay had revealed to me. I had been told and had known that I was fortunate, even undeservingly so. I had known also that in the head wind of a constant adversity, men and women such as those I met that summer instinctively found something to ennoble their lives and spirits. In a sense I learned nothing new, and yet I was reminded of many things that are easy to forget. ■

***Christopher Amar** is a senior at Lexington High School in Massachusetts. He plans to major in English at college.*

Lost Moment

The cold, dark alley,
Leaves blowing in the colors of fire.
The cool breeze stiffens the skin,
    hurling the leaves up in the air.
And then releasing them,
    as they fall,
    gently rustling against the street.
The smell of wet asphalt emanates from the road,
    as distant cars buzz along.
A gunshot, a police car whizzes by the intersection.
The dull, gray buildings stand unaware,
    uncaring.
An old man carts his life down the road,
    loneliness crying from his aching bones.
He walks to his home,
    a few boxes lying to the side of the alley.
Newspapers folded neatly at the end of a cardboard bed.
A prayer, and the man nestles in the bed,
as a black cat stalks by.

—Rabindra Watson

***Rabindra Watson** is a senior at Los Altos High School in California, where he competes on the varsity water polo and swim teams. This year, he has been the managing editor of* **The Talon**, *the monthly school newspaper.*

The Razor, *continued from page 8*

1945
The RAZOR
1995
Too little time for activities?

career paths that former editors have chosen. Some are active journalists and published authors; others have drawn upon their reporting experience to excel in other fields, such as the 25th Editor-in-Chief, Harold Koh, now a distinguished professor of law at Yale.

We invited Professor Koh to reflect on his *Razor* experience in an all-school assembly before we distributed the issue. "*The Razor* taught me about the power of the printed word...the power to persuade, the power to change people's minds. There is nothing that compares with finally reading your own words in print—somehow, they look different, even after all the thinking, and researching, and writing—and to this very day a chill runs up my spine when I see my latest book or article or brief come back in print."

Professor Koh concluded, "Whether the newspaper is inputted on a hand-held computer, delivered by fax, downloaded from cyberspace, scanned off an optical disk, or bounced off a satellite...there will be a printed version of *The Razor.*"

But the nature of communication is changing. It is possible—in fact, likely—that in the future, school newspapers like *The Razor* may embrace more advanced digital media and transmit over the Internet. We have already begun publishing pages on the World Wide Web, and this is clearly just the beginning. To expand upon Professor Koh's remarks, we hope that, regardless of how *The Razor* is produced in the future, its editors will continue to cherish the power of the printed word.

Who knows? Perhaps in 50 years the *Razor* staff of 2045 will print a special commemorative issue on *historic paper* to celebrate the paper's centennial! ■

***The Razor*'s home page is at http://www.hopkins.edu/razor**

It's Finale Time at MATHCOUNTS and ARML

> **A mathematical problem should be difficult in order to entice us, yet not be completely inaccessible, lest it mock our efforts. It should be a guidepost on the tortuous paths to hidden truths, ultimately rewarding us by the pleasure in the successful solution.**
>
> *—David Hilbert, International Congress of Mathematicians, 1900*

It is spring, when young people's minds turn to thoughts of … math competitions. Math contests give students with a strong interest in mathematics the opportunity to hone their competence and creative problem solving abilities in an exciting, competitive arena. The natural environment of most of the contests is one that blends individual thrills with the joys of teamwork. Competitors get to advance their mathematical abilities, test the waters of intense competition, and develop meaningful friendships all at the same time.

MATHCOUNTS

Two major math competitions culminate each spring. The national round of MATHCOUNTS held in Washington, D.C.—this year on May 10—serves as the dramatic pinnacle of a year's worth of work in the MATHCOUNTS program for students in grades seven and eight. This finale builds on in-school, regional, and state rounds of individual and team competitions held earlier in the year. The four top-scoring students from each state contest go on to train for the nationals.

At National MATHCOUNTS, participants compete not only on these four-member teams representing their states but also as individuals. College scholarships are awarded to the top placing team, written competition winner, Master's Round winner, top scoring female, and the National Champion.

Ten students qualify to vie for the title of National Champion, based on their individual scores in the morning's written semifinals. The ten meet in the final event, the Countdown Round, a fast-paced, game show-like competition. In this one-on-one oral elimination event, students race the clock as they try to solve each problem in 45 seconds. As this description suggests, MATHCOUNTS aims to provide its participants, or "mathletes," with the challenge and excitement often associated with sports events.

ARML

A few weeks later, the largest on-site mathematics competition in the country takes place. The American Regions Mathematics League (ARML) annual national event—this year on May 31 and June 1—is held simultaneously at three sites: Penn State University, the University of Iowa, and the University of Nevada at Las Vegas.

The nation's most advanced high school mathematics students, along with a few middle-schoolers, meet and compete at the ARML finals, forging their cutting-edge mathematical skills in the fire of timed, non-routine problem solving.

No fixed criteria dictate the make-up of local ARML teams, which are typically created out of community interest and commitment. In some states, top scorers at regional events gain membership on fifteen-member All-Star state teams; after these squads face off, the state sends a team or teams composed of its highest scorers to the national competition. In other states, the process is less formal, and an individual county or even a school may choose to send a team of its own to the nationals.

Topnotch math competitions are complex events. At the ARML nationals, for example, participants compete in the following: a Team Round (teammates work cooperatively on short-answer questions), a Power Round (teammates work on a challenging multi-part problem requiring several kinds of analysis and proof), a Relay Round (individuals answer questions building on teammates' previous answers), and an Individual Round—all in one day.

DEVELOPING PROBLEM SOLVING SKILLS

While unfamiliar, deeply challenging mathematical problems can be intriguing in their mystery, one important purpose of math competitions is to demystify the process of solving such problems. According to Dr. Harold Reiter, Professor of Mathematics at the University of North Carolina, "There is no doubt that problem solving is a skill that can be learned.… Teachers foster problem solving abilities whenever they give you problems you can't resist. Once you're hooked, your natural curiosity compels you to keep searching for the solution—and for new problems."

True for students in classrooms, it is also true for those invited to participate in prestigious math competitions.

Alok Bhushan is a tenth grader at Thomas Jefferson High School for Science and Technology in Virginia. He has participated in ARML since the seventh grade; this year, for the first time, he participated as a member of his high school's A team (TJHS has a B team, too). According to Alok, "The majority of problems that I have encountered at ARML events seem unfamiliar at first. There is this strange moment in which I am looking at a problem and have little sense of how it might connect to other kinds of problems that I have encountered in the past; after a short while, though, I am able to make some kind of connection."

Extracurricular math activities can be time consuming. Alok spends two hours a week practicing for ARML participation. And, of course, coaches are required; three teachers organize the TJHS practices. "But it's lots of fun," explains Alok. "I like the competitive aspect." ■

Biological Research Using Molecular Biological Approaches

by Carol Blackburn

> "There was a door to which I found no key;
> There was a veil past which I could not see..."
>
> *The Rubáiyát of Omar Khayyám*

Some technological innovations enhance our ability to do things we can already do, while others fundamentally expand the range of our capabilities, forever enlarging the scope of human activity. The typewriter enhanced our ability to apply ink to paper, but antibiotics revolutionized our ability to fight bacterial infections.

The development of molecular biological technology falls into the latter category. This ever-expanding battery of techniques has revolutionized our ability to explore and modify the biological world. The extraordinary pace of technological innovation in this area has continued unabated since the 1970s, when these techniques first began to have a profound impact on research in nearly all areas of biology.

How did the development of these tools change biological research? Before this revolution, scientists could, to a large extent, study only the *consequences* of gene expression. Since the revolution, they can study and manipulate the genes *themselves*.

It's not that the scientists of yore never wondered about the questions today's biological researchers can now address. They wondered, and they used the tools available to them to get as far as they could in answering their questions. But there was always a technological limit to how far they could pursue questions concerning genetic activity—always a veil past which they could not see.

The molecular biological revolution has parted that genetic veil, and the explosion of research that has followed has been unprecedented. Information encoded in genes can now be studied directly. In the following two interviews, we are fortunate to be able to share with you insights from two internationally renowned researchers who use these techniques to answer questions in their very different areas of interest: developmental neurobiology and oncology.

The two have somewhat different perspectives. Dr. Goodman is a basic scientist whose work is turning out to have potentially important clinical implications, while Dr. Vogelstein is a clinical researcher whose desire to improve diagnostic and therapeutic procedures has led him to make important discoveries in basic science.

Both now use molecular biological techniques, although neither was trained as a molecular biologist. Both came of age as scientists during this technological revolution, so they witnessed and had to adjust to enormous change during the first twenty years of their careers.

Indeed, more than merely adjusting, these two scientists have made exceptionally good use of the opportunities afforded them by the new technologies. Both express the excitement they feel as questions that could never before be addressed experimentally have become answerable, and both emphasize that the feverish pace of research in fields that use molecular biological techniques will continue for many years to come. ■

SELECTED RESOURCES

For a history of the scientific discoveries at the heart of the molecular biological revolution:

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For more about Dr. Vogelstein's research:

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EXPLORING CAREER OPTIONS

Focus on Biological Research

by Carol Blackburn

INTERVIEW WITH COREY GOODMAN: DEVELOPMENTAL NEUROBIOLOGIST

Corey Goodman, Ph.D., is Head of the Division of Neurobiology in the Department of Molecular & Cell Biology at the University of California-Berkeley. When he received the prestigious Alan T. Waterman Award, awarded each year by the National Science Board to a scientist under the age of 35 who has already made a significant contribution to his or her field, the citation read: "For his contributions to our understanding of the development of the nervous system. His imaginative choices of model systems and modern technologies are enabling him to discover how individual nerve cells acquire their unique identities and interact with the appropriate cells during embryogenesis."

Our readers may be less familiar with the field of developmental neurobiology than with oncology (our other interviewee's area of expertise). Could you outline the context of your research and perhaps give us a glimpse of its clinical implications?

Certainly. I work with insects, so I'm often asked, "Why are we spending tax dollars studying bug brains?" I study fundamental questions about how nervous systems develop, using the fruitfly as what biologists call a "model system": one that is much simpler than the one you would like to understand—the human brain—but is a lot easier to study. Fortunately, the molecular mechanisms of neural development appear to be so highly conserved across evolution that insights gained from research on the fruitfly can be applied to our understanding of the human nervous system. As we figure out how nervous systems—be they fruitfly or human—grow during normal development, we're generating the knowledge and the tools to study what occurs in disease or injury. Building on the discoveries we're now making, it should someday become possible to help damaged nerve cells regenerate connections after spinal cord or brain injury, or to reverse or perhaps prevent neurodegenerative diseases.

How did your interest in research develop?

I started doing scientific experiments on my own when I was in high school. In addition to the usual science labs, my school had a special independent projects lab for students, where I spent many long hours. I also spent a wonderful summer at the Jackson Laboratory in Bar Harbor, Maine, where I did all sorts of interesting mouse genetics, played softball, and climbed mountains.

Corey Goodman

But that only describes a part of me. My high school years were also filled with playing in a rock band and participating in student politics, debate, and sports. It was the '60s. Kids of my generation didn't worry as much about our futures as kids do today. Instead, we listened to a lot of music and talked about politics and life.

How did you go about clarifying your interests?

I sampled around a lot. From early on, it was pretty clear that, while I did well in many subjects, I preferred biology. But it wasn't clear what area within biology I might want to pursue.

One summer during college, I did clinical research in a hospital, and that was an eye-opening experience. I appreciated the desire the researchers had to do things of direct relevance to people. But, despite the strong expectation many people had that I would become a doctor, it was clear to me by the end of the summer that I wanted to be a basic scientist. That experience showed me something about myself: I was happiest trying to solve fundamental questions about life.

My freshman year at Stanford, I did research in population biology and evolution. That was fun, but it wasn't *it*. Evolution is a hard topic to do experiments on—it's mostly observational—and I realized that I wanted to work on puzzles I could study experimentally. Later, I did research in circadian rhythms, and that was fun, too, but it didn't grab me. I was definitely searching for a biological problem that would turn me on for the long term, and I hadn't found it yet.

How long did you have to continue searching?

The fall of my junior year, I took a neurobiology class with a fabulous teacher. A part of me had been exploring consciousness (it was, after all, the '60s), thinking about the mind and the brain. And here, all of a sudden, was neuroscience—the basis of thought, perception, and memory. Pretty cool stuff!

Clearly, this was it. By the end of that quarter, there was no question—I was going to be a neuroscientist. And it even went further: I wanted to figure out how the brain got wired up. A human brain has 10^{12}-10^{13} nerve cells, each of which makes a thousand connections. And you wonder, "How do you make 10^{16} connections? And how do you come out with a nervous system that works?" I was drawn to that question right from the start.

That course was a real lightning bolt for you.

It changed my life. After I graduated, I went to Berkeley to study neuroscience, and I've been doing it ever since, pursuing that interest I developed junior year in college: how does a brain get wired up? I'll probably be working on that question for most of my professional life.

You've had a powerful, unifying vision throughout your career.

I think it's worthwhile having a question, goal, or issue to pursue, rather than jumping around doing lots of different things. There's something satisfying about a scientific career in which you try to answer some fundamental question.

While your focus has remained constant, the methods you've used have changed considerably over time. Could you talk about that evolution?

Yes, keeping up with the technical advances is part of the fun—and challenge—of science. For my Ph.D. thesis, I tackled the old nature vs. nurture question, using the state-of-the-art tools of neuroscience in the '70s. I chose the grasshopper as my model system because its nervous system is relatively simple, with many fewer cells than in more complex nervous systems like ours; yet at the same time the nerve cells—or neurons—are comparatively large. In fact, some are large and distinctive enough to be identifiable from one grasshopper to the next. It was thus possible for me to look at these neurons in many different grasshoppers, to see how similar their patterns of connection were from one organism to another.

To better examine the 'nature' half of the question, I figured out a way to breed grasshoppers that were genetically identical, allowing me to look at those patterns of connection in identical twins. I could ask, "How much of the variability we observe from one organism to the next is based on genetic and how much on environmental differences?"

It sounds as though you weren't just keeping up with the advances—you were making some of them.

That's true. At some point during my graduate studies, though, I realized that my approach wasn't going to get me where I wanted to go. I was always left at the end of my papers speculating about how the connections I studied had developed, how unknown genes and unknown processes could have influenced them. I realized that I didn't want to beat around the bush in those ways—I wanted to actually study those processes.

Before choosing a post-doctoral position, I did some hard thinking. If I wanted to understand how neural connections develop, looking at fully formed nervous systems and trying to imagine what had gone on during development just didn't do it. To study how connections come to be, I would have to observe them in the process of forming. What I needed was to find a way to study the development of neural connections in a growing embryo.

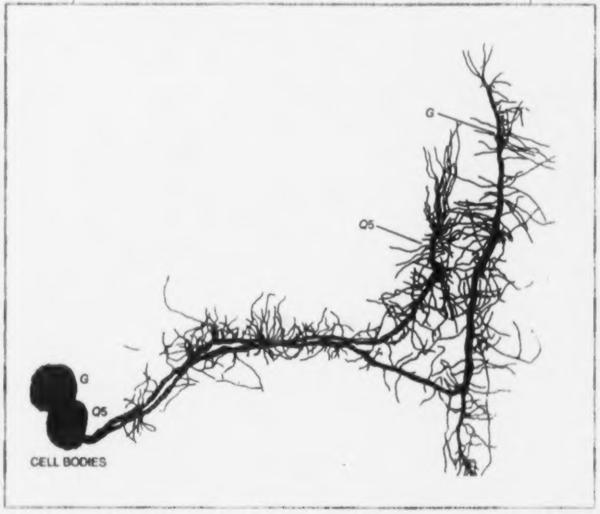
I began searching for the best organism in which to study this development in the living embryo. Interestingly, after searching through many phyla, I concluded that the best model system was the very one I was already studying: the grasshopper. It has the largest embryo of any insect you can conveniently raise in a laboratory, and like the adult, the embryo has large neurons.

But I needed something else as well—a means of visualizing these relatively large cells—and for that I turned to a new kind of microscopy (called Nomarski optics) which allowed me to look at living tissue. So, for my post-doctoral work, I chose to use Nomarski optics to study how neural connections develop in the grasshopper embryo.

You put a lot of thought into your choice of model system and technical tool to use for your post-doctoral research.

Yes, I did, but it was well worthwhile. At the time, these sorts of studies were impossible to carry out in most other organisms. The grasshopper embryo was special; it was ideal for my experiments. That combination of model system and technical approach allowed me to study things that no one else was studying at the time.

When I started as an assistant professor in 1979, I continued to use this approach. But by the late '70s, a technological revolution was taking place, and it became clear that we could better answer our questions if we took advantage of certain technical advances. (I say "we" because, by the time you're a professor, you've reached a point where you're thinking up the experiments, but they're being done collaboratively by you, your students, and your post-docs—it's a group effort.)



Drawing of two growing neurons from a grasshopper embryo.

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You learned new experimental techniques even after you became a professor?

Absolutely. I recruited superb post-docs trained in the techniques I wanted to learn, and I and my grad students learned from them. The first new tool we brought into the lab was monoclonal antibodies, probes that allow us to chemically "tag" specific proteins on the surface of cells. It was very exciting to be able to show that certain cell surface proteins were found on particular subsets of neurons, like chemical pathway markers for neurons to follow as they grow. It looked as if the developing nervous system had a series of labeled pathways that helped growing neurons find their way.

The next technical advance we adapted for our studies was the revolution in molecular biology—the ability to manipulate genes and DNA. Using these techniques, we were able to move from tagging cell surface proteins to identifying the genes that encoded those proteins. Suddenly, we could ask, "Which genes code for the molecules we have been studying? What turns them on and off at specific times and places? What regulates and coordinates their sequence of activation?"

Being able to use molecular biological tools really catapulted your research into new terrain.

It certainly did, in more ways than one. No sooner had we begun to identify genes than we decided we wanted to be able to mutate them and examine the consequences of such changes on the developing embryo—to see what happens to nervous system development when individual molecules are removed from the chain of events.

But this kind of sophisticated genetic manipulation wasn't possible in the grasshopper. So we made *another* major shift, to a new model system—an insect which, while it's much smaller and thus more difficult to see under a microscope, is the superstar of genetic research: the fruitfly *Drosophila*. To make this shift, we had to develop methods to visualize embryonic fruitfly neurons with the same clarity we had when studying the grasshopper. Once we could do this, we were off and running using this new (to us) organism.

So, throughout my graduate education and even after I became a faculty member, I continued to make a series of changes, always trying to think, "Where do I want to go, and how can I get there?" More specifically, "What would I like to know about brain development, and what experimental approach could give me that kind of information?" If you can actually see how to get where you want to go—the techniques to use, the experiments to do—that's wonderful. Back in the '70s, it wasn't at all clear. I had plenty of good questions, but the tools available to me gave me only tantalizing hints. The invention of molecular biological techniques made it possible to imagine how to answer my questions.

What, if any, have been the rocky places for you?

The more you know, the more you're also very aware of all that you don't know. So a problem I felt very profoundly, especially at every transition, was the impostor syndrome. I always thought, "People who say nice things

Continued on page 18

EXPLORING CAREER OPTIONS:

Focus on Biological Research

by Carol Blackburn

INTERVIEW WITH BERT VOGELSTEIN: ONCOLOGIST

Bert Vogelstein, M.D., Professor of Oncology at the Johns Hopkins University School of Medicine, has been a pioneer in the application of molecular biological approaches to the study of human cancer. In 1987, he and his research group identified a cluster of genes that, when they go awry, cause colon cancer. Since then, they have gone on to confirm that cancer is caused by genetic damage and to study the changes that occur in a variety of cancers as they progress. He is recognized as one of the foremost cancer researchers in the nation and has topped Science Watch's "hot scientists" list for the last three years.

How did your career interests develop?

I was always interested in science and math. After majoring in math at the University of Pennsylvania, I nearly decided to go to graduate school in mathematics. Math was extremely challenging and satisfying to me, but I wanted to do something that was more applicable to people's problems. I decided therefore to go to medical school, even though I'd had little biological training, because it would give me a good feel for problems that could at least in theory be solved through science.

I first became interested in cancer when I was a medical student because it was at that time (the early '70s) such a black box, such a giant puzzle. Then, in my internship and residency, I began to take care of kids with cancer. I saw firsthand that cancer was a tragic disease that needed a lot of work, and I felt that trying to investigate cancer would be a useful way to spend my life.

So I did a post-doctoral fellowship at the National Cancer Institute to learn more about cancer and molecular biology, which was then in its infancy. Afterwards, I returned to the Oncology Center at the Johns Hopkins Hospital. I knew I wanted to work on cancer, but at that point I had no idea of exactly what to do. I just felt that if I kept trying different experimental approaches, sooner or later I'd stumble onto one that would be a doorway into the puzzle of cancer.

That's an important point—to have a big picture in mind. It doesn't matter if you can envision the details of the plan to reach the goals. If you have some idea of what excites you and keep working at it, sooner or later you'll come up with something. I've known very few people who, if they've persisted, haven't realized at least a part of their dream.

Photo by Craig Terkowitz

Bert Vogelstein

What factors do you believe have been important in the success you have achieved?

I don't know that there's any single element that can explain our success. First of all, I say "our," not "my," success. In most biomedical laboratories, research is carried out by a group of people who work in a collegial, interactive way, not by a single individual. So I would say that the most important ingredient in our success has been a series of incredibly talented young people who have had goals similar to mine and who have worked very hard to attain them.

The second thing is hard work, for which there is no substitute. People in our lab routinely work 12-15 hours a day. And they do so because they're excited about their research. If someone's not really excited about doing science, he or she shouldn't be doing it—it's too hard. It has to be something that you wake up in the morning and can't wait to do, something you're absolutely driven to do. Only if you have that kind of fire in the belly, as well as requisite levels of competence, intelligence, and logic, is it likely that you'll succeed.

And the final ingredient, of course, is luck. Unless you're blessed with good luck at least some of the time, it won't go. But the saying, "Chance favors the prepared mind," is also true. If you persevere at something, your preparation and hard work may eventually meet the luck.

In your field, you've managed to stay ahead of the wave instead of riding it. Do you have a sense of what has allowed you to make choices that have turned out well in the long run? I guess I'm asking about "the vision thing."

Vision's always easy in retrospect. Scientists are often asked to predict the future—how long will it be until we get to Mars or cure cancer?—and they're notoriously bad at it. And the reason is that scientists are trained to be conservative, chained to probabilities and data. Historically, the people who have been most successful at predicting the future have been science fiction writers, not scientists. I think that someone like Jules Verne was able to foresee future innovations because, not being a working scientist, he wasn't chained by what was possible at the time; he could look past the limitations of the current technology.

So I think it's helpful in science to have a combination of the science fiction writer and the bench scientist: on the one hand, to have a feeling—or at least a suspicion—that a thing can be done, even if it can't be done *now;* and on the other, to have enough familiarity with current technologies to envision the rough outlines of a path to get from here to there.

How have you combined these two perspectives?

One principle that has stood me in good stead is this: If I think something can be done, and the great majority of my peers assure me that it's impossible, then I *know* it's worth doing. If I know in my gut that something has a chance of working, I'm tremendously excited if no one else thinks so, because then I know I have the opportunity to do something that's truly novel.

For example, when we first decided to study human cancer experimentally, we were told that such research would not be productive, that we should study simpler systems in tissue culture or in animal models. A lot of very bright and experienced people told us this. And we were very glad to hear it because we knew…

…that this was one of those times when you were going to be able to run with the ball?

Yes, this was going to be one of those times. And we were pretty confident because a whole new area of biotechnology—the techniques for cloning and identifying genes—was just coming to adolescence, so to speak. Our underlying hypothesis was that it was the genes that went awry in cancer, and this new technology would give us terrific new tools to test our hypotheses—tools that had never before been available. Using those techniques, we and others have been able in just a few years to do things that had never before been technically possible: to identify and study genes whose aberrant forms cause certain cancers.

Have you ever felt frustrated by the limitations one faces in doing human research?

No, not at all. Of course, there are things that one can't do, for technical or ethical reasons, in humans. But there are *a lot* of things that one *can* do, especially now, with molecular biological approaches. In cancer research, in particular, we have a tremendous resource here at Hopkins. Every cancer that has been removed from a patient at Johns Hopkins since the hospital began over a hundred years ago is still here, preserved in wax in a huge basement room. And—speaking of vision—the pathologists who saved those tissues had the foresight to realize that one day maybe they would be valuable, even though nothing of scientific value could be done with them at the time. Now, we can use those tissues to great experimental advantage, pulling out the genes and finding out what's wrong with them.

There are, of course, frustrations in science. Most experiments—90% of them—don't work. You *usually* fail. That's not clear from what's written in the lay press. But you talk to any bench scientist—someone who's actually doing experiments—and go through his or her notebooks and you'll see failure after failure, with an occasional success. If you're buoyed enough by that one success that you can get through the next ten failures, you're going to be fine. But you *have* to be able to tolerate failure; that's an integral part of enjoying this profession. You have to enjoy failure in the sense that even from failures you learn something.

Your work spans an unusually broad range, with strong elements of both clinical and basic research. How important are these two kinds of curiosity or motivation to you?

Intellectual curiosity is certainly part of what drives the scientific process in cancer research. Some questions in cancer research are very basic ones: "What makes a cancer cell behave differently from a normal cell?" That is a very fundamental question. And it's a different sort of question from, "How can we prevent cancer from occurring in a patient who has some predisposition?" These questions reflect different basic concerns, and individual researchers are motivated to different degrees by the two.

In my case, for whatever reason, what most motivates me is the latter question. What drives me is the challenge of actually helping people who have been stricken by a devastating disease. And what really thrills me is when we learn enough to actually do something to help people: to design tests that detect early cancer or that help us know who is at risk of developing cancer, eventually perhaps to develop new forms of therapy.

Now, if we have to find out why cancer cells are different from normal cells to design better forms of therapy, then I'm more than willing, *I'm excited,* to try to find out. But intellectual curiosity is not the underlying motive that drives me. It does drive a whole community of researchers who are quite legitimately interested in cancer because of the intellectual challenge, and it will take both kinds of drive to make significant progress against the disease.

However, achieving that sort of understanding can take a long time. Furthermore, even once you understand a disease, it can take a long time to develop successful therapeutic treatments based on that understanding.

That process can take a long time. However, from the outside, it looks as though developments are now happening very quickly in cancer research. From the inside, does it feel as though your understanding of cancer is increasing quickly?

Oh, it's happening *incredibly* quickly. The increase in our understanding in the past 10-15 years has been nothing short of revolutionary. Thanks to the efforts of thousands of researchers all over the world, there's now a relatively solid understanding of the outline of the disease, although many details remain to be filled in. It's clear that it's a genetic disease. Many of the genes that go awry and then cause cancer have been identified and cloned. In some cases, the precise mutations have been characterized right down to the atomic level.

From the public's perspective, though, these gains in understanding are not as revolutionary because they have not yet been translated into gains in treatment or prevention. And that's understandably frustrating, especially for patients.

But I think one needs to keep some sort of historical perspective. Even with polio, which was a much simpler disease than cancer, it took 30 years to go from defining the cause of the disease—identifying the virus—to a vaccine for polio. There's no reason to expect that it's going to take much less time to go from understanding cancer to being able to do something that will eradicate most cancers. It may take many decades. However, the precedent is clear; historically, once a disease is understood, it's only a matter of time before patients are helped. So I'm very optimistic; it will just take time, and there's nothing we can do to rush it except keep working hard.

And making progress, at every step along the way, is not trivial. There's no straightforward path from understanding a disease to translating that knowledge into better ways of treatment or prevention. It's going to require *at least* as much hard work and vision and creativity and luck—probably more—to translate our current knowledge into therapeutic innovations as it has to generate the revolution we've just talked about. So there's *a lot* to be done. And if young people have the talent and the inclination to spend their lives doing it, they're needed.

So there will still be plenty of work to be done in cancer research ten years from now, when some of our readers will be in graduate school?

Absolutely. The only thing that will be different is that the techniques available to us will be even more powerful. The research tools used in biomedical research today are just phenomenal. Things that we routinely do in the lab would have been considered absolute science fiction when I was a student; things that, twenty years ago, might have taken a year—if you could do them at all—now take an hour. And developments in technology feed on themselves, producing a continuing cascade of developments. Ten years from now, people will be doing things that can't possibly be imagined today. So this is absolutely the golden age of biomedical science, and it's only going to get better in the foreseeable future.

Is there anything else you would like to add?

One hears a lot of talk about current funding difficulties, but anything worthwhile is difficult. Being successful in biomedical research is not more difficult than being successful in any other highly competitive human activity.

Finally, I would add that the most important thing is to go with your gut. Get advice from all sources, put that into your own personal computer, but then be driven by what *you* think is the right thing to do. If you can envision yourself chasing after some important goal, even though other people might laugh at it now, then you're going to have a good time trying to get there. And you may even get there. It's worth a shot. ■

MATHEMATICAL PROBLEM SOLVING TECHNIQUES

by Alexander Saeed

Off to the Races!

Solution to Grand Prix problems posed in our March/April issue.

To solve this problem, the first step I would take is to rephrase it into mathematical terms:

What is the ***lowest*** final score I could get and still finish first? Second? Third? Fourth?
What is the ***highest*** final score I could get and ***not*** finish first? Second? Third? Fourth?

To find the lowest score I could get and still place first, I would distribute the points as evenly as possible among the eight racers; the first-place winner would lead a low-scoring pack of racers, winning by a hair.

Here's a chart to show my thinking:

Racer	1	2	3	4	5	6	7	8	Sum
Race									
1	9	6	3	1	0	0	0	0	
2	3	6	9	1	0	0	0	0	
3	0	0	0	9	6	3	0	1	
4	0	0	0	1	6	0	9	3	
5	1	0	0	0	0	9	3	6	
Total	**13**	12	12	12	12	12	12	10	95

Racer #1 would win a narrow victory with 13 points, the lowest possible final score that can result in a first place.

What is the lowest score I could get and still place second? That outcome would occur if (1) the first-place winner amassed the maximum possible score of 45, ***and*** (2) the remaining points were distributed as evenly as possible among the other seven racers. Then, as in the previous case, the second-place winner would be just ahead of the remaining racers.

Racer	1	2	3	4	5	6	7	8	Sum
Total	45	**9**	7	7	7	7	7	6	95

Determining the highest possible score I could get and ***not*** finish nth is an easier task: distribute the top scores (e.g., 9's and 6's) as evenly as possible among n+1 racers. So, for the best score that does not win first place, distribute the top scores between two racers as follows:

Racer	1	2
Race		
1	9	6
2	6	9
3	9	6
4	6	9
5	9	6
Total	39	36

Racer #1 wins with a score of 39, and despite a great score of 36 (out of a possible 45), racer #2 finishes second.

Here are the rest of the answers. How did you do?

Highest score that does not finish nth:

Place	Score
1	36
2	27
3	22
4	18

Lowest score that still finishes nth:

Place	Score
1	13
2	9
3	5
4	2

On May 22, ***Alexander Saeed*** *received a B.A. in biology/psychology and an M.A. in psychology from The Johns Hopkins University. Now 17, he is doing research in molecular biology under Nobel laureate Dr. Hamilton Smith.*

Focus on Biological Research, continued from page 15

about me don't know just how much I don't know." I sometimes felt people had unrealistic expectations of me.

Eventually, I came to grips with this. It's not that I think I know more than I did before—in fact, I'm more aware than ever of the things I don't know and the places where I have to use instinct and dig deep to get myself through. It's just that I've come to realize that everyone is in the same boat. Now I'm suspicious of anyone who doesn't have a bit of humility in that way.

One of the keys to continuing to do good science is to be willing to admit what you don't know. Be prepared to take on new approaches, and don't worry about the fact that you didn't have formal training in them. Learn them. Continue to be the student.

What you see happening in some scientists is that they get too rigid, afraid of being criticized or of changing, so they stick with the same thing. In biology, you can usually tell by the time scientists are in their mid-to-late 30s whether they're going to continue to be creative. If they get rigid and hide behind something they do well, that's the kiss of death; by the time they're in their 40s, they're going to be history.

Looking into your crystal ball, what do you see happening in your field five to ten years from now, when some of our readers start graduate school?

By the time some of your readers are beginning their own journey down this road of scientific discovery, I hope a few of them will find this field as exciting as I do and will join our endeavor. Understanding the brain will still be one of the greatest frontiers in biomedical research. The old-timers (by then, that will include me, although I'll always think of myself as a kid trying to learn new techniques) will have learned the basic vocabulary of how nervous systems are put together, but we'll still be clueless about the grammar. We'll know about a lot of different molecules involved in the process, but we won't yet know how all those molecules are assembled to build a dynamic, functioning brain.

In some ways, the next generation of scientists will have the most fun. My generation will have done the dirty work of discovering the bits and pieces, cloning the genes, figuring out how the individual pieces of the puzzle work. But we won't have put the puzzle together. They'll have the fun of figuring out how to assemble the puzzle. It's going to be a long time before our brain is able to fully understand how our brain is put together, how it works, and how it changes as we live and learn. ■

THE COACH'S CORNER

by Chengde Feng

SOLUTIONS TO THE MATH PROBLEMS FROM THE MARCH/APRIL ISSUE.

Mr. Feng teaches mathematics at the Oklahoma School of Science and Mathematics (OSSM) and has coached many students who have competed successfully in mathematics contests in China and the U.S. In this column, Mr. Feng offers *Imagine* readers questions designed to improve their problem-solving skills.

1.

Let $x=\frac{\sqrt{7}+1}{2}$. Then $2x-1=\sqrt{7}$ and $4x^2-4x+1=7$ and $2x^2-2x-3=0$.

Since $2x^5-2x^4-x^3-4x^2-x+2=(2x^2-2x-3)(x^3+x-1)-1=-1$, $f(\frac{\sqrt{7}+1}{2})=(-1)^{1996}=1$.

2.

(1) Proof: $f(x+2)=\frac{1+f(x)}{1-f(x)} \Rightarrow f(x+4)=\frac{1+f(x+2)}{1-f(x+2)}=-\frac{1}{f(x)} \Rightarrow f(x+8)=-\frac{1}{f(x+4)}=f(x)$.

Therefore $f(x)$ is periodic with period 8.

(2) $f(1994)=f(2+8\times249)=f(2)=\sqrt{3} \Rightarrow f(1996)=\frac{1+f(1994)}{1-f(1994)}=\frac{1+\sqrt{3}}{1-\sqrt{3}}=-(2+\sqrt{3})$.

3.

(1) Any integer of the form $4k+2$ is not a *wisdom*. (why?)

(2) $4k+3=(2k+2)^2-(2k+1)^2 \Rightarrow$ Any positive integer of the form $4k+3$ is a *wisdom* when $k\geq0$.

(3) $4k+4=(k+2)^2-k^2 \Rightarrow$ Any integer of the form $4k+4$ is a *wisdom* when $k\geq1$.

(4) $4k+5=(2k+3)^2-(2k+2)^2 \Rightarrow$ Any integer of the form $4k+5$ is a *wisdom* when $k\geq0$.

From (1), (2), (3), and (4), it follows that the *wisdom sequence* $\{w_n\}$ is defined as follows:

$w_1=3$, $w_2=5$, $w_{3n}=4n+3$, $w_{3n+1}=4n+4$, and $w_{3n+2}=4n+5$ for $n\geq1$.

Therefore, the 1996th *wisdom*, $w_{1996}=w_{3\times665+1}=4\times665+4=2664$.

4.

(1) Prove first $x_1+x_2+x_3+x_4+x_5 \leq 110$.

If not so, then $x_5 \geq 25$. (why?) and $x_1+x_2+\cdots\cdots+x_9 > 110+26+27+28+29=220$.

It contradicts the given fact.

(2) $x_1+x_2+x_3+x_4+x_5=110$ when $x_1=20$, $x_2=21$, $x_3=22$, $x_4=23$, and $x_5=24$.

So the maximum value of x_1 is 20 when $x_1+x_2+x_3+x_4+x_5$ attains its maximum.

(3) $x_6+x_7+x_8+x_9=110$ when $x_6=26$, $x_7=27$, $x_8=28$, $x_9=29$.

So the minimum value of x_9 is 29 when $x_1+x_2+x_3+x_4+x_5$ attains its maximum.

Therefore the possible minimum value of x_9-x_1 is 9 when $x_1+x_2+x_3+x_4+x_5$ attains its maximum.

5.

PROOF: (1) Select n rows such that the number of chessmen in each of these rows is no less than that in each of the remaining n rows. Let $p_1, p_2, \cdots\cdots, p_n$ be the numbers of chessmen in these selected rows. It can be proven indirectly that $p_1+p_2+\cdots\cdots+p_n \geq 2n$. (Assuming that $p_1+p_2+\cdots\cdots+p_n \leq 2n-1$. Then at least one row contains ≤ 1 piece, and the sum of the numbers of the chessmen in the remaining n rows $\geq n+1$ so that at least one of the remaining rows has more than one chessman. This contradiction implies that $p_1+p_2+\cdots\cdots+p_n \geq 2n$.)

(2) After having chosen the n rows, the proof can be completed simply by choosing the n columns where all the rest of the chessmen ($\leq n$) are located.

FASCINATING CLASSICS

The Catcher in the Rye

by J.D. Salinger

Review by Lesley Mackay & Ned Balbo

Lesley: J.D. Salinger's *Catcher in the Rye* is one of the most widely read novels of the twentieth century. The book presents the inner world of a sixteen-year-old who is at odds with his school, his family, and the expectations he must face in order to move from childhood to adulthood.

Holden Caulfield, the hero, is also narrator. The book covers a few days in his life—days of deep personal crisis. Holden's tale begins with his expulsion from a prestigious East Coast boarding school; he has simply flunked out. He decides to drift around his hometown of New York City, connecting with his little sister and a girl or two in whom he is interested. His plan is to wait until his parents expect him at the term's end, when he will reappear and face their response to his failure in school.

Ned: But the reality of waiting out the end of the semester in New York proves overwhelming for Holden, who experiences powerful feelings of isolation and despair. Many aspects of his likable personality help him to control the onslaught of desperate feelings: amazing powers of observation, an unusual degree of insight into other people, and great humor.

Still, two or three days on his own get the best of him. When he returns home, he is physically and emotionally exhausted; his parents send him away to California where his older brother, D.B., lives and where Holden receives institutional care. His story, the novel we read, appears to be a tale told to a psychologist or some other care giver at the institution where he temporarily lives. It's easy to forget this important detail once under the spell of the narrative.

Lesley: Ned, what do you make of Holden's state of mind, his dislike of so much around him and, relatedly, his inability to meet others' expectations? Do you find him a normal teenager in a phase of great disdain for the world around him, or does his rejecting attitude seem extreme to you?

Ned: Holden reacts in extreme to problems that are mostly typical—and, in some cases, self-created. He's a wonderful storyteller, and it's easy to be seduced by his intelligence, to assume that his negative judgments of the world and other people are sound.

Because the book is a first-person narrative, the reader has no alternative to Holden's own point of view. Yet the book's intensely personal perspective is exactly what allows us such a powerful experience of Holden's interior life and a full appreciation of what is happening to him.

Lesley: What *is* happening to him? Holden is growing up; at sixteen, he is on the cusp of early adulthood. While many young people look forward to entering the adult arena, for Holden, the prospect of maturing is a bleak one that provokes an identity crisis. Early on in his narrative, he suggests the deep confusion that will become more evident as the novel unfolds:

> *I act quite young for my age sometimes.... It's really ironical, because I'm six foot two and a half and I have gray hair. I really do. The one side of my head—the right side—is full of millions of gray hairs. I've had them ever since I was a kid. And yet I still act sometimes like I was only about twelve. Everybody says that, especially my father. It's partly true, too, but it isn't all true.*

I think that Holden's head half full of gray hairs represents a side of him that is already adult—even old.

Ned: I agree. And further evidence of Holden's partial precocity is found in his advanced powers of verbal manipulation. A storyteller in every sense, Holden readily admits that he frequently lies. Sometimes, he aims to impress: he may, he explains, tell someone he is going to the opera when he is simply out for a stroll. On other occasions, he lies to head off trouble or to please others.

Holden is also breathtakingly honest. In fact, the single desire that drives him throughout this book is for an honest encounter with another human being—an encounter free of the hypocrisy he observes around him. In the opening scene of the novel, Holden visits his elderly history teacher, Mr. Spencer, to reassure him that he should feel no discomfort in flunking him—that, in fact, Holden has already flunked out of the entire school. But Mr. Spencer does not react generously to Holden's self-deprecating overture. He reprimands Holden and gives him a warning: Holden must learn to accommodate rules and expectations if he wants any success in life. Mr. Spencer may be right, but he is blind to Holden's need for warmth and a reason to hope.

Lesley: Mr. Spencer's brittle response sets the tone for Holden's largely disappointing encounters with other people throughout his sojourn in New York. Adrift in the city, he turns to a variety of individuals for contact and comfort: a girl, Sally Hayes, on whom he has a crush; a sophisticated young man he had admired at another school; a former teacher who had always seemed compassionate; and his little sister, Phoebe.

Along with Allie, Holden's younger brother who had died two years before, Phoebe is the individual whom Holden holds in highest regard. He trusts Phoebe, enjoys her, and respects her judgment. With Phoebe, Holden can share his vulnerability and the truth about his difficulties.

Ned: Holden's feelings for Phoebe and Allie are warm partially because these siblings represent a lost innocence. D.B., though, has completed the passage into adult life. A writer who once composed short stories that Holden greatly admired, D.B. has become a screenwriter and moved to Hollywood; in Holden's view, he has therefore given up his integrity. Still, D.B. possesses an answer to the dilemma that torments Holden: how does one become an adult? It makes sense that, at the end of the novel, D.B. has become Holden's guardian; he is the Caulfield who can best help Holden finally make the necessary transition.

Lesley: I agree with you, Ned. Holden's relationships with his siblings—both living and dead—are very important. But Holden says almost nothing about his parents.

Ned: Parents are bound up in the two dimensions of life that Holden trusts the least: the economic and the sexual. Holden's father, an investment banker in Manhattan, operates squarely within the boundaries of the financial world, although he does so with varying success: Holden refers to his father's tendency to invest in shaky Broadway productions. And, of course, parents have a bond that is sexual.

Lesley: I think that you are getting to the heart of his difficulties, Ned. What Holden finds preposterous is society's unspoken expectation that he fit his emerging sexuality and his passionate responses to life with the way society actually works.

In a number of Holden's rejections of people or institutions, we can detect an immense discomfort with any combination of ideals and finances. Pencey Prep, for example, the school from which he is expelled, revolted Holden with its "phony" pretense of intellectualism; he thinks that the school merely serves the economic interests of the boys who attend it and of their families.

And in a quite different arena, Holden has terrible trouble getting along with a girl to whom he is greatly attracted. Sally Hayes so relishes the courtship ritual that Holden can't muster any respect for her. With her wholehearted enjoyment of attracting eligible suitors, Sally signals her willingness to approach love as a social and economic proposition. In this way, she loses Holden, who is desperate for signs of authentic, uncomplicated feeling.

Ned: Of course, Holden is no saint. Much of the book is devoted to his ambivalent musings about girls and the powerful ways in which they affect him. What is so striking about Holden, though, is his tremendous self-awareness and wit in describing what he perceives to be his weaknesses. Holden's feelings of desire disturb him deeply. It is not that he cannot accept them, but that he doesn't yet know how to respond to them. He experiences his sexual interest in women as something of a curse or a blight.

Lesley: A blight. I like your word choice, Ned. Let's look that term up. It means, "any of several plant diseases that destroy leaves, growing tips, or the entire plant," and then, "an adverse environmental condition." Holden does experience his feelings of desire partially in this way, as an affliction that is eating away at the tranquil season of childhood.

Ned: That season and the loss of it are what *The Catcher in the Rye* is all about. Of course, childhood cannot be fully appreciated until it is lost. Holden's impressive ability to talk about the melancholy of growing up is a sign that intellectually, at least, he is largely an adult.

The ideal of childhood in this book is expressed in its title, which, Holden explains, comes from a line in a poem by Robert Burns. For Holden, this poem has come to life in an elusive, heartfelt dream: he becomes a "catcher in the rye," a grownup in a rye field on the edge of a steep cliff. In this dream world, his job is to monitor all the children at play in the field and to ensure that none falls off the cliff.

Holden's dream suggests his anxieties about death, including the death of his young brother, Allie. But going over the cliff also signifies growing up. Holden's impossible dream is that he can protect other children—as he may wish he had been protected—from having to become an adult.

Lesley: His dream conveys great compassion. Holden is always concerned about other people's sufferings: the nun collecting money from strangers, the children who see swear words scrawled on the walls at the playground, the old teacher who must give him a failing grade.

In fact, one of my favorite motifs in the book shows the range of Holden's empathy. Several times, he alludes to the plight of ducks in winter: where do they go when the cold weather descends? We first read of this concern in the book's early pages, when Holden is trying to communicate during his miserable visit with his history teacher, Mr. Spencer:

The funny thing is... I was sort of thinking of something else... I live in New York, and I was thinking about the lagoon in Central Park, down near Central Park South. I was wondering if it would be frozen over when I got home, and if it was, where did the ducks go. I was wondering where the ducks went when the lagoon got all icy and frozen over. I wondered if some guy came in a truck and took them away to a zoo or something. Or if they just flew away.

In this moment Holden is indeed worried about these ducks, but he is also worried about himself. Sitting and listening to Mr. Spencer's insensitive bluster, Holden gets a taste of the unsympathetic responses that his expulsion from school will arouse in the adults in his life. Like the ducks he impulsively thinks of, in this moment, Holden cannot be sure of his home.

Related to this, it is important to point out that adults do fail Holden in the course of this novel. Holden may not be an entirely reliable narrator, and it is uncertain whether his parents support him through his troubles or not. But it is clear that adults, such as his teachers Mr. Spencer and later the abhorrent Mr. Antolini, do let Holden down.

Ned: Yes. Holden may feel rebellious, but he also hungers for some kind of adult mentorship, or at least sympathy. Throughout the book, he looks up former teachers and an older student and engages many random adults in conversations. Yet those who have grown up seem unwilling or unable to help him.

At the same time, the book is framed in an important understanding: Holden survives and even prevails. How? The book itself is evidence that Holden has assumed his own voice—one that is funny, sympathetic, and unique. While he sinks into the depths of despair in the course of the narrative, he also reemerges through the act of creating the narrative.

Holden has become a storyteller, an artist. Recalling, weaving, and making some sense of the threads of prior events have allowed him to accept the past. The calm in his voice in the book's final chapter suggests that he is also ready to accept the prospect of the future. ■

Looking for Summer Reading?

Next year we will focus on **Literature from Different Cultures**. The books (in order) will be *Their Eyes Were Watching God*, by Zora Neale Hurston; *Kim*, by Rudyard Kipling; *House of the Spirits*, by Isabel Allende; *A Portrait of the Artist as a Young Man*, by James Joyce; and *Cry the Beloved Country*, by Alan Paton. Please join us as we explore and discuss these exciting and important works.

Lesley Mackay

Ned Balbo

***Ned Balbo** holds advanced degrees in writing from Johns Hopkins and the Iowa Writers' Workshop. He currently teaches in the Writing and Media Department at Loyola College in Maryland. **Lesley Mackay** is IAAY's staff writer and has taught literature and composition at Indiana University.*

STUDENTS REVIEW

CARNEGIE MELLON UNIVERSITY

College Review Series

This on-going series is intended to aid prospective college students in their search by offering insiders' views of selected colleges and universities, as expressed by current undergraduates or recent graduates who have exceptionally high academic ability. Our reviewers all share high expectations for a college's academic standards and its nurturance of emerging talent.

Note that the number of student reviewers is small. Consider their personal perspectives as only one component while you gather factual information and impressions from such other sources as college catalogues, site visits, talks with officials and students on campus, and the advice of your guidance counselor and teachers.

Carnegie Mellon University

Our reviewers include twelve students, who major(ed) in anthropology (1), chemical engineering (1), computer science (CS) (3), drama (1), economics (2), electrical & computer engineering (ECE) (3), electrical engineering (1), literary studies (1), materials science & engineering (1), mathematics (3), physics (1), professional & technical writing (3), and Russian (1). (The number of majors exceeds twelve because several students have double majors.) Students' comments appear within quotation marks.

Quality of Academic Instruction for Undergraduates

Founded in 1900 as the Carnegie Institute of Technology, CMU now includes six undergraduate colleges: CIT, the College of Fine Arts, the College of Humanities & Social Sciences, the Mellon College of Science, the School of Computer Science, and the School of Industrial Administration. Today CMU is highly regarded not only in technical disciplines but also in fine arts and architecture. It can boast both the #1-ranked computer science graduate department in the nation (according to a recent survey published in *U.S. News and World Report*) and Oscar-, Tony-, and Emmy-Award-winning alumni. Reviewers gave high marks to the education CMU delivers.

"Excellent. The engineering curriculum is very innovative and promotes critical thinking. The professors know just how to challenge our minds. CMU has provided me with great technical and analytical skills which have prepared me to enter industry or graduate school."

"Superb. The main reason I chose to come to CMU was the outstanding reputation of the faculty, and they have surpassed my expectations. I know they are teaching the latest information from the real world, not just rehashing what they learned in grad school. Many of them also work in the real world during the summer and school breaks and occasionally on sabbaticals. CMU professors are not only successful in their fields but also great educators and very approachable—I have all of my professors' home phone numbers. The caliber of the student body is also exceptional; half of what I've learned in college I've learned from fellow students."

"The engineering curriculum here tends to be more flexible than at other tech schools. Although the curriculum during the first two years is very rigid, with lots of core courses, the schedule in the final two years leaves more room for electives. Students in the engineering college have a year to decide on their major, rather than having to declare when they apply. The ECE core curriculum is pretty tough, but even in ECE we get one year of electives which can be used to complete the master's program or take up additional majors or minors."

"I'd have to say that all of the ECE and CS classes are topnotch. The core curriculum makes sense."

"It varies. CMU is famous for certain majors (CS, ECE, architecture, drama, industrial management) and less so for others, so obviously it's better at some things than others. Overall, though, I think it's generally excellent; poor courses and instructors tend to disappear quickly. The library resources of CMU are undoubtedly the worst part of the academic experience. Any student doing serious research will find him/herself at the library at the University of Pittsburgh, which (fortunately) grants library privileges to CMU students."

"The student-professor relationships at CMU tend to be cordial, but professional. While intro level courses are large (up to 150 students), most upper level classes (typically 15-25 students) allow for a great deal of individual attention. CMU has perhaps the best computing environment of any school in the world; there is approximately one computer for every two students."

Social Life

Reviewers agree that CMU is a "geek heaven" but that it has a great deal more to offer socially.

"The computer cluster seems to be a common hangout for all types of students. Computer experts and 'geeks' come from all different majors—English, engineering, arts. If you like computers, you'll love CMU, regardless of your major."

"When talking with friends from other schools, one of the first questions I hear is, 'Isn't CMU filled with computer geeks? How much fun can that be?' That bothers me every time I hear it. I don't think CMU is filled with computer geeks, and I have a lot of fun! However, college—no matter where you go—is what you make of it. If you take advantage of the 100-plus organizations, the 40-plus intramural sports, the Greek system, or the surrounding Pittsburgh area, you're going to have a great time at CMU."

"CMU is a fairly urban campus, with all the positives and negatives that entails. Pittsburgh is an excellent city for college students—fun and comparatively safe. There are museums, theaters, coffeehouses, and shopping areas within walking distance of campus."

"There is a perception that all CMU students do is work, work, work—but this is definitely a myth. We have fun, when scheduling permits. Sometimes you have to seek it, but it is there."

"The workload at CMU has a dampening effect on extracurricular life. CMU has a decent female/male ratio; however, in engineering, almost everyone is male. On a more optimistic note, if you were a shy/passive type in high school, CMU could be your chance to take a leadership role in a variety of extracurriculars. Unlike academics, many of CMU's extracurriculars are not all that competitive. There is plenty of room for new initiatives, new leaders."

"The best thing about CMU's social life is the intermingling of fine arts and humanities with science and engineering. On no other campus will you find students so

strong in such completely divergent areas. As a student body, we learn a great deal from each other and are not afraid to come together as friends. My best friends include engineers as well as English and drama majors. My CS friends took me to a virtual reality exhibit, and I brought them to a musical. This diversity makes the college experience so much richer."

"Ultimately, I would describe CMU as more of a mosaic than a melting pot. The tech and fine arts students hook up in the student center, dorms, and extracurricular activities, but usually not in the classroom. While some students ***do*** *pursue both technical and arts majors, it's difficult to do so because the top majors at CMU are so intense and have so many requirements."*

What Do You Like Best about CMU?

Reviewers cited the excellent technical education, the research and pre-professional opportunities, and the caring faculty.

"The opportunities for undergraduates to do research are tremendous: small research grants (yes!) are almost routinely given to undergrads. Faculty in all departments generally welcome anyone who wants to work with them. I have been doing research for two years now and have been challenged and encouraged every step. I love it!"

"I am a junior and have already made a number of important contacts in the professional world. The faculty are an excellent resource for getting jobs, and the alumni connections are incredible. Most of all, my professors care about me and what I'm learning. They come in on weekends and spend late nights on campus helping students succeed."

"The ***excellent*** *computer facilities and the focus and intensity of the technical education. People do well coming out of CMU because they* ***are*** *so specialized and concentrated in their field of interest. There is some criticism of the lack of diversity in this type of education, but, to be honest, I think that if CMU did not concentrate on its strong areas, its best graduates would not be as well prepared as they currently are."*

"Before I came, I pictured CMU as a place where there was cutthroat competition. I was pleasantly surprised to find the students here quite friendly and very helpful. There is always someone you can turn to when you need help."

What Do You Like Least about CMU?

The workload and attendant stress topped the list; some reviewers also cited the weather.

"CMU is an achievement-oriented campus; many students who cannot constructively deal with stress lapse into alcohol abuse, depression, etc. Don't get me wrong—it's a great school, but you need a support network."

"The atmosphere here can be pretty oppressive."

"The weather in Pittsburgh can be awful. At times, it's cold and rains almost incessantly."

CARNEGIE MELLON UNIVERSITY

Pittsburgh, PA 15213
(412) 268-2082

- 4-year private coed university
- Urban campus in a largely residential section of Pittsburgh
- Full-time undergraduate enrollment 1995-96: 3,121 men; 1,451 women
- Special features: Center for the Neural Basis of Cognition, Robotics Institute, and Software Engineering Institute. The annual Spring Carnival includes a high-tech buggy race, with tiny, aerodynamically-streamlined vehicles designed and built by student groups and fraternities.

Who Would Be Most Compatible with the Academic and Social Atmosphere at CMU?

The consensus: focused pre-professionals.

"Computer types. People who have some plan for their college education. CMU is ***not*** *the place for you if you're going to college to 'explore' or 'find' yourself."*

"Someone who already has a strong focus—drama, architecture, CS, etc. Students declare their majors at the end of freshman year. This is in stark contrast to many schools, where you can explore until junior year, then declare a major in the subject in which you happen to have the most credits."

"Someone who enjoys a challenge and who doesn't need a lot of rah-rah school spirit. People who really love computers will be in heaven here."

If You Had It to Do over Again, Would You Go to CMU?

Nine reviewers said yes; three had mixed feelings.

"Absolutely. CMU has been a perfect match for me. I wanted an urban school with an excellent reputation which was small enough that I would not be just a number. I am really happy here."

*"****Definitely.*** *I love CMU! I get charged up just walking around campus. You can feel the energy. The many research opportunities and top academics make this a wonderfully exciting place to be."*

"Yes. Although engineering is to be my career, I wanted to pursue other interests as well. CMU's diverse academic strengths allowed me to do that. The friendly social atmosphere has also been great. I know artists, singers, and historians, as well as fellow engineers. The excellence one finds in such widely disparate fields is what makes CMU unique."

"Yes!! When comparing notes with friends from other schools, including Harvard and MIT, I found that I had more opportunities to do real research as an undergrad than most of them did."

"Yes. You can do anything you want career-wise in ECE or CS with CMU's undergraduate preparation."

"This is a tough question. In the final analysis, my four years at CMU brought me a great deal of knowledge and skill in critical thinking and helped me find myself personally. At the time, though, I often found the narrow focus of the rigorous engineering curriculum stifling."

As you try to find the college or university best suited to you, the views of CMU presented above may be helpful. Keep in mind that these students might have had similar positive or negative experiences had they attended a different university. At any college, it is important for the individual student to seek out challenging academic experiences and the best professors and to create a social life that best fits his or her personal style. ■

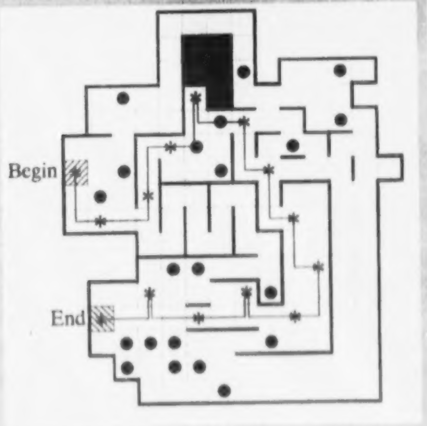
Note: The students quoted in the College Review Series are expressing their own views, which are not necessarily those of JHU or IAAY.

CREATIVE MINDS

ImaGiNe...

Submit your creative work—brain teasers, short stories/essays/book reviews. We look forward to hearing from you.
Please write to *Imagine* • SET at IAAY • The Johns Hopkins University • Baltimore, MD 21218

Solution to Puzzle in March/April '96 issue of *Imagine*, by Tim Boester:



With this issue, we bid a fond farewell to **Tim Boester,** *who is moving on to new endeavors after having intrigued* Imagine *readers with his puzzles for the past three years. Thanks for the challenges, Tim!*

ANOTHER PUZZLE

by Tim Boester

DIRECTIONS:

This final puzzle is a variation on one we printed last year. It's complicated, so we're giving you the whole summer to work on it. Two examples help clarify the rules.

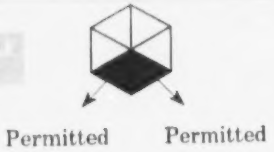
First, the easy part:

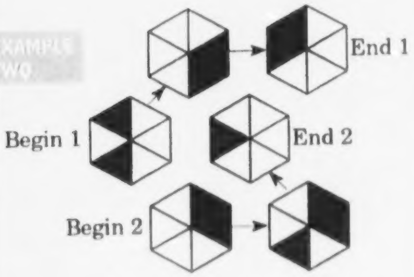
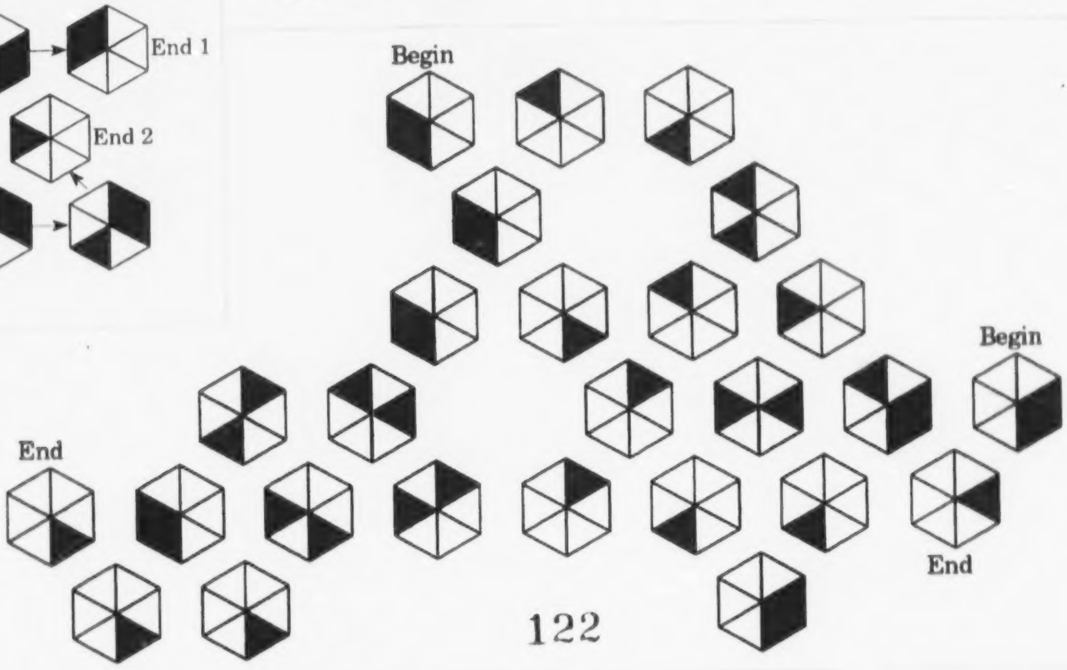
- This puzzle involves **two** players who take turns jumping one hexagon at a time.
- Each player begins at a different hexagon marked *Begin*.
- Players **are** permitted to move onto hexagons previously occupied by the other player, but both players cannot simultaneously occupy the same hexagon.
- Each player must reach a different hexagon marked *End*.
- Since the two players alternate moves, they must arrive at the hexagons marked *End* in successive moves. If, for example, Player #1 arrives at one *End* hexagon on the seventh move, Player #2 must arrive at the other *End* hexagon in the next move.

Now, the hard part:

- The filled sector(s) on the hexagon occupied by *one player* indicates the direction(s) in which the *other player* is permitted to move.
- **Example 1:** If one player was on this hexagon, the filled sectors indicate that the other player would be permitted to move southeast or southwest, taking north as the top of the page.
- **Example 2** provides a several-move illustration. Player #1 begins at the hexagon marked *Begin 1*. The filled sectors on Player #2's hexagon *(Begin 2)* indicate that Player #1 may move either NE or E. After Player #1 moves one hexagon NE, he/she stands on a hexagon that permits Player #2 to move either E or SE. This process continues, with both players landing on hexagons marked *End* in their second moves.

EXAMPLE ONE



EXAMPLE TWO